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# Engineering
# NEWS-RECORD

June 2, 1938

*Sight distance cars used for national road survey*

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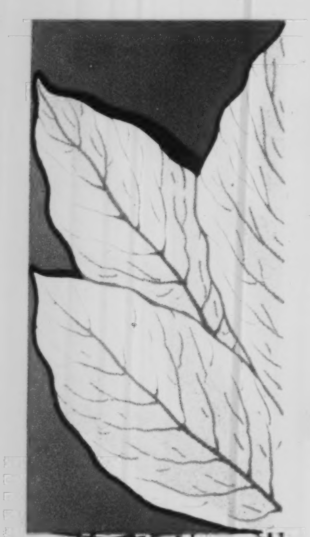

# WROUGHT IRON
## ON ITS OWN
# 40-YEAR
## RECOMMENDATION

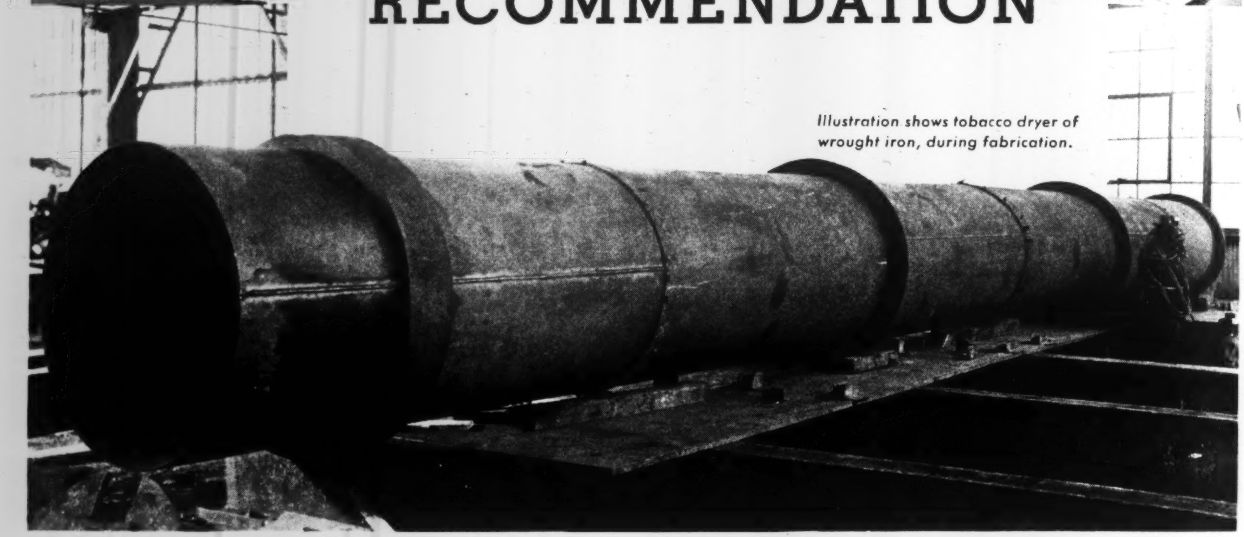

*Illustration shows tobacco dryer of wrought iron, during fabrication.*

• Many installations of wrought iron result from the good account that this durable material has already given the user in some other services.

When one of the largest tobacco manufacturers recently installed a tobacco dryer, the plant engineers simply took a leaf from their own experience — and chose wrought iron. This same firm has been using wrought iron pipe for approximately 40 years, in steam lines, condensate returns, boiler feed and process lines.

Material selection becomes easy when you rely on experience — either your own or that of others with similar installations. We will be glad to furnish you with performance records of applications in which you are interested. Many of these are in our book "101 Uses for Wrought Iron" — yours for the asking. When you review them, you will find that in corrosive services, or those hard to maintain, wrought iron shows longer life and avoids costly premature replacements.

We will also be glad to assist you in making a study of the corrosive conditions in any of your current projects. Just let us know the type of project and its location. Get in touch with our nearest Division Office or write our Engineering Service Department in Pittsburgh.

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Vol. 120 *JUNE 2, 1938* No. 22

## THIS WEEK AND NEXT

*ALL THE FACTS that are essential to the development of a national highway-transport system are being assembled by state highway departments and the Bureau of Public Roads. Methods of collecting the statistics are described in this issue. Next week—methods of analysis.*

*The dumping of twelve million yards of Riker's Island refuse on top of a deep formation of East River silt to create New York City's new airport at North Beach is both a bold engineering undertaking and a ticklish grading job. How it is being done, and a brief description of the ultramodern airport for both land and sea aircraft are given in this issue.*

*Navigation through the Cape Cod Canal is being improved by widening and deepening which raised question as to the possible serious effect of changed flow condition. These questions have been answered through the aid of model studies.*

*With no sound rock within 186 miles of the dam, engineers of Keystone Dam in Nebraska began experiments with fused bricks as riprap. Tests were so successful that the material is included in the specifications as an alternate to rock.*

*Super service in garbage collection is provided at Lansing where householders are supplied with a steam sterilized container every time a collection is made. Details of the procedure and the equipment used are given on p. 788.*

*FOUR ARTICLES on significant soil studies in connection with highway construction are to be published in June issues. Two relate to soils in pavement base and fills and two to cement stabilization. The latter will provide the most up-to-date information on this important development in road work.*

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THE COVER PICTURE shows an Ohio sight-distance survey unit, part of the national highway survey program which is described in a two-part article beginning in this issue on page 773.

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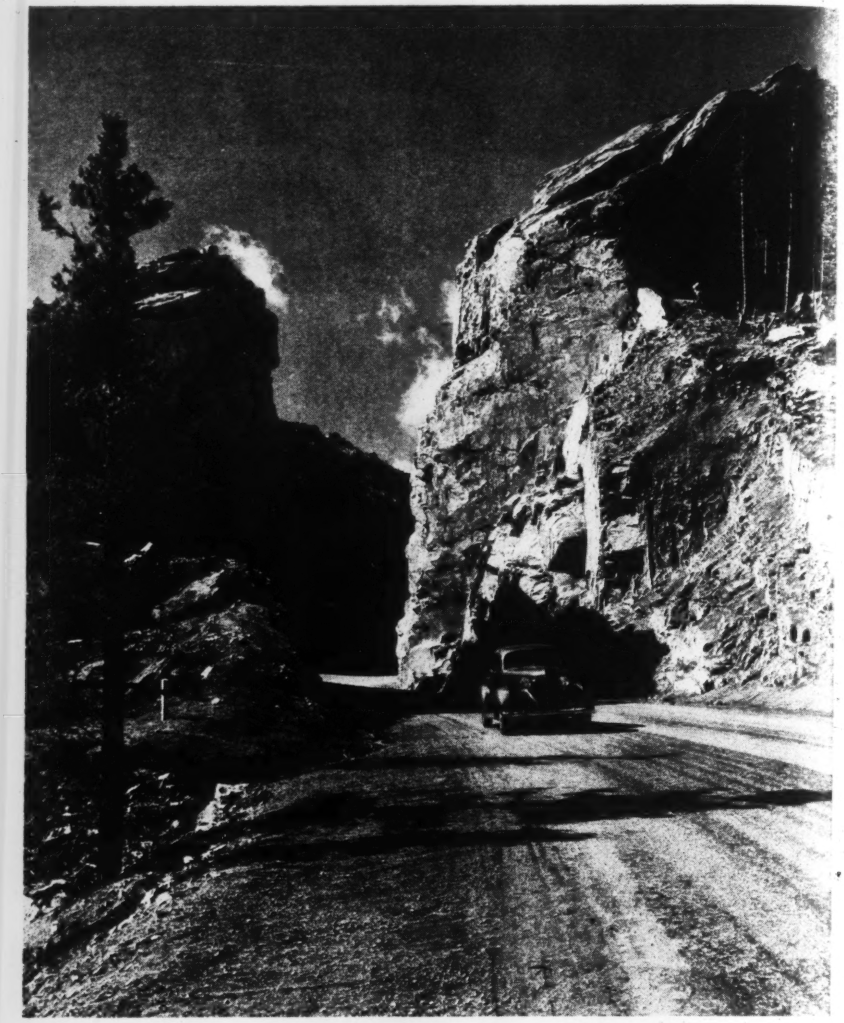

★

America's NEW ROADS await your inspection ★

Whether you travel the highways this summer as a vacationist or in a business capacity, you will marvel at America's splendid new roads.

Never in the history of our country has so much thought been given to the building and maintenance of good roads, the result of which will be observed regardless of the direction you may choose to travel.

The makers of TONCAN IRON *Corrugated Metal Drainage Pipe* take this opportunity to salute highway officials of the Federal and State, County, Township and Municipal Governments, whose willing cooperation and untiring endeavor have given America the best in good roads and the world's greatest highway system. » » » » » » » »

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*JUNE 2, 1938*

# *THE WEEK'S EVENTS*

## *Revenue Bonds Upheld By Utah Court*

**Court also holds competitive bids are not necessary on projects outside municipal debt limit**

A municipality may issue bonds in excess of its debt limit when the bonds are secured only by the revenues from the project which they are to finance, the Utah Supreme Court held in a decision handed down May 16. The Utah court had previously upheld the legality of revenue bonds but always in cases involving special features which left some doubt as to the general case.

The court also held that in building a project financed by revenue bonds, a municipality need not advertise publicly for bids.

The present case arose in 1936 when the city of Ogden entered into a contract with A. C. Todd, under which Todd agreed to build a municipal power plant and distribution system and to take payment in $2,600,000 of special revenue bonds to be liquidated from the net earnings of the proposed plant. The Utah Power & Light Co. obtained a temporary injunction against carrying out of the contract and asked the supreme court to declare the contract illegal. The intermountain branch of the Associated General Contractors also intervened in the case in support of the power company.

The company attacked the contract on a number of grounds, of which the principal ones were: that the bond issue would bring the indebtedness of the city above the limit established in the state constitution; that the city was obligated to meet any deficiency in revenue from the plant with tax money from other general revenue; and that the city did not advertise for bids before entering into the contract. The company also charged that its business would be destroyed by the plant.

In its decision, the supreme court threw out the latter claim on the ground that the power of the city to build a municipal plant had long been recognized under state law.

The court found that the provisions of the contract were such that the revenue bonds were not an indebtedness against Ogden City and were therefore not void or invalid because of the debt limitation set in the state constitution. In no event, the court held, will the city be legally or morally obligated for their payment.

On the legality of revenue bonds, the court said, "The steady growth in recent years of the practice of financing by this method the purchase or construction of public utilities by cities and towns, as denoted by increasing and now general recognition and approval of the special funds doctrine by the courts, affords persuasive, and indeed convincing, evidence of its soundness and utility. As such, it is pe-

*Continued on page 766*

• • •

## *Ohio River Compact Terms Agreed On*

Commissioners appointed by the governors of eight states in the Ohio Valley agreed May 24 on the draft of a proposed water-sanitation compact for the Ohio Valley. The compact, of which the terms have not been announced, will now go to the legislatures of the several states for ratification.

Drafting of the proposed compact got under way about two years ago when the Governor of Ohio invited governors of the states in the valley to appoint a commission to study the matter. Commissioners were appointed a year ago and they have been working on the proposed draft since.

States represented on the commission are Ohio, New York, Illinois, Indiana, Kentucky, Pennsylvania, Tennessee and West Virginia.

## *MAJOR NEWS*

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## *Average Cost Found On PWA Housing*

**Construction cost on 33 projects averages $1,169 per room exclusive of land and utilities**

Following the same methods which it uses in its regular reports on costs of private residential construction, the Bureau of Labor Statistics has determined that the construction cost of 33 housing projects constructed by PWA averaged $1,169 per room and $4,126 per family dwelling unit.

This figure covers only construction of the dwelling facilities. It does not include land costs and does not include such items as street paving, electric distribution systems outside of buildings for yard lighting, social and recreational buildings, rentable office buildings, trunk line sewers, and the like. Inclusion of these later items, but not of land, would raise the total contract price per dwelling unit to $4,358 and per room to $1,235. Such items are excluded in the bureau's computation of private costs.

The 33 projects studied include seventeen southern and sixteen northern projects. The average dwelling unit cost for seventeen southern projects was $3,568, and room cost $1,060. For the sixteen northern projects, the dwelling unit cost was $4,472 and the average room cost $1,232.

• • •

## *Canada Plans Program Of Public Works*

The Canadian administration has introduced into the House of Commons supplementary estimates for the current year providing for expenditure of about $40,000,000 on what are described as "work creating projects."

Outstanding items of expenditure, in addition to the usual annual amount for public building and harbor structures, include: $1,500,000 for new road construction in the mining area; an additional $1,000,000 for grade crossing improvements; an additional $1,000,000 for canal improvements; more than $1,000,000 for airport construction; and more than $2,000,000 for youth training schemes.

## Senate Road Aid Fund Upped in Conference

### Increased tax diversion penalty is dropped from conference version of federal-aid bill

A federal-aid bill making some increases in the amounts provided in the Senate version of the bill was reported to the two houses of Congress May 26 by a conference committee. Where the original House version provided $125,000,000 for federal-aid to the states in each of the years 1940 and 1941, the Senate version would have provided $75,000,000 in 1940 and $115,000,000 in 1941. The conference report retains the Senate figure for 1941 but increases the 1940 figure to $100,000,000.

The authorization for secondary roads, reduced from the House figure of $25,000,000 by the Senate to $10,000,000 in each year, was increased in conference to $15,000,000 each year. Grade crossing elimination, for which the House would have provided $50,000,000 each year, was held by the conference committee at the Senate figures of $20,000,000 and $30,000,000. All other items in the bill likewise followed the lower Senate figures.

### *Diversion penalty*

The section of the bill providing for increased penalties on states which divert portions of their highway tax revenues from highway purposes was eliminated in conference, and if passed in its present form the bill will carry only the penalty for diversion provided in the 1934 act. The new provision had been stricken out by the House but was restored by the Senate.

A provision, introduced in the Senate, which would have required the Secretary of Agriculture to fix standards of design in cooperation with the state highway departments was eliminated from the conference version.

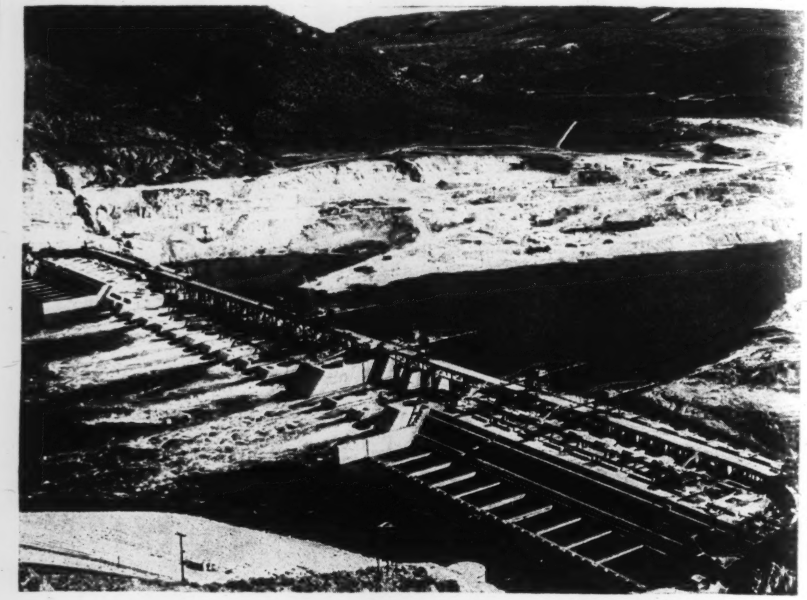
Retained, however, was the Senate provision directing the Bureau of Public Roads to investigate and report on the feasibility and cost of a federal system of superhighways.

• • •

## New York Drawing Plans For Superhighway

The New York State department of public works is settling upon a route for a proposed superhighway from Albany to Buffalo which would cost more than $100,000,000. The route is being settled upon in anticipation of an early appropriation by the legislature to start construction, but no actual legislative action has been taken as yet.

The proposed road would parallel U.S. Route 5, bypassing all cities and villages. It is planned that the highway have at least six traffic lanes and be at least 300 ft. wide. It would not include grades of greater than 3 per cent nor curves of greater than one degree, and the highway would have no grade crossings.



*Bureau of Reclamation Photo*

HIGH DAM GETS UNDER WAY

HAMMER-HEAD cranes are strung out along a trestle across the completed low dam at Grand Coulee to handle concrete, as work on raising the dam to its final 550 ft. is put under way by the contractors.

ENGINEERING CONSTRUCTION CONTRACTS REPORTED BY ENGINEERING NEWS-RECORD, IN MAY, 1938

Engineering News Record *reports projects of the following minimum costs; Water-works, excavation, drainage and irrigation, $15,000; other public works, $25,000; industrial buildings, $40,444; other buildings, $150,000.*

Four Weeks—Thousands of Dollars (000 Omitted)

| | New England | Middle Atlantic | South | Middle West | West of Mississippi | Far West | United States<br>May 1938 | United States<br>Five Months<br>1938 | United States<br>Five Months<br>1937 | Canada |
|---|---|---|---|---|---|---|---|---|---|---|
| **Public Works** | | | | | | | | | | |
| Waterworks | 679 | 24,219 | 620 | 1,183 | 1,449 | 469 | **28,619** | 44,074 | 37,700 | 198 |
| Sewerage | 321 | 2,246 | 25 | 2,090 | 1,159 | 387 | **6,228** | 41,380 | 43,795 | 45 |
| Bridges, public | 693 | 3,579 | 359 | 2,516 | 290 | 231 | **7,668** | 34,091 | 44,816 | 290 |
| Earthwork and waterways | 57 | 1,563 | 1,105 | 785 | 3,516 | 3,707 | **10,733** | 95,474 | 36,948 | 64 |
| Streets and roads | 1,953 | 11,971 | 6,286 | 7,424 | 12,169 | 7,547 | **47,350** | 185,107 | 134,333 | 1,046 |
| Buildings, public | 977 | 4,711 | 830 | 2,551 | 2,998 | 4,033 | **16,100** | 147,361 | 125,854 | 285 |
| Unclassified, public | 134 | 6,982 | 582 | 669 | 1,074 | 670 | **10,111** | 46,035 | 53,403 | 1,267 |
| **Total public** | **4,814** | **55,271** | **9,807** | **17,218** | **22,655** | **17,044** | **126,809** | **593,522** | **476,849** | **3,195** |
| Federal government (included in above classifications) | 80 | 1,825 | 1,461 | 413 | 1,703 | 3,961 | **9,443** | 98,381 | 72,281 | ........ |
| **Private** | | | | | | | | | | |
| Bridges, private | ........ | 1,641 | 62 | ........ | ........ | 60 | **1,763** | 4,249 | 3,896 | ........ |
| Buildings, industrial | 2,174 | 2,210 | 6,482 | 1,068 | 1,642 | 1,206 | **14,782** | 79,514 | 202,157 | 515 |
| Buildings, commercial | 4,550 | 23,028 | 1,340 | 3,300 | 2,626 | 1,965 | **36,809** | 312,103 | 195,197 | 1,190 |
| Unclassified, private | ........ | 1,206 | 451 | 900 | 608 | 478 | **3,643** | 42,477 | 92,930 | 190 |
| **Total private** | **6,724** | **28,085** | **8,335** | **5,268** | **4,876** | **3,709** | **56,997** | **438,343** | **494,180** | **2,895** |
| **Total Engineering Construction** | | | | | | | | | | |
| **May, 1938 (4 weeks)** | **11,538** | **83,356** | **18,142** | **22,486** | **27,531** | **20,753** | **183,806** | ........ | ........ | **6,090** |
| April, 1938 (4 weeks) | 11,406 | 94,478 | 14,815 | 20,132 | 37,734 | 14,809 | **193,374** | ........ | ........ | 9,069 |
| May, 1937 (4 weeks) | 12,528 | 131,004 | 19,914 | 28,259 | 25,090 | 18,217 | **235,012** | ........ | ........ | 18,207 |
| Five months — 1938 | 46,179 | 471,512 | 97,699 | 119,958 | 167,778 | 128,739 | ........ | 1,031,865 | ........ | 28,071 |
| Five months — 1937 | 48,313 | 453,516 | 84,959 | 154,161 | 132,890 | 97,190 | ........ | ........ | 971,029 | 52,071 |

# THE CURRENT TREND

*This week's news of contract volume and construction cost factors*

## THIS WEEK'S FIGURES

(Thousands of Dollars)

### CONTRACTS

| | Week Ending June 3 1937 | May 26 1938 | June 21 1938 |
|---|---|---|---|
| Federal ............ | $6,510 | $1,697 | $2,034 |
| State & Municipal | 17,886 | 22,618 | 32,679 |
| Total public...... | $24,396 | $24,315 | $34,713 |
| Total private..... | 11,210 | 8,535 | 10,537 |
| TOTALS .......... | $35,606 | $32,850 | $45,250 |

Cumulative
1938 (22 weeks).........$1,077,115
1937 (22 weeks).........$1,006,635

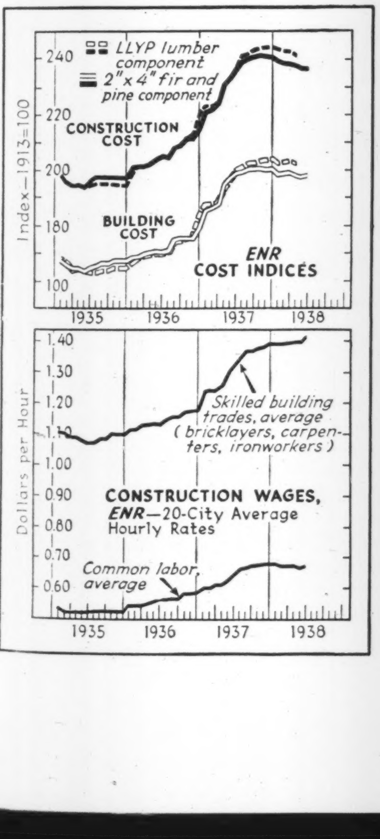
Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

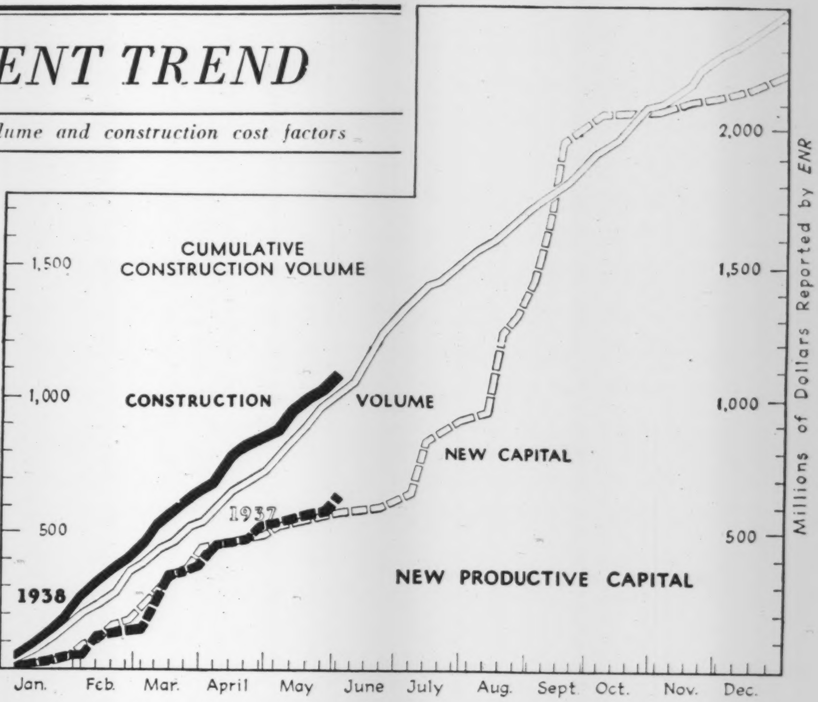
### NEW PRODUCTIVE CAPITAL

| | Cumulative 1937 22 Wk. | 1938 22 Wk. |
|---|---|---|
| NON-FEDERAL ........ | $575,287 | $592,594 |
| State & Mun. bonds.. | 237,488 | 297,921 |
| Corporate securities... | 267,011 | 175,474 |
| PWA loans, grants.... | 40,849 | 2,036 |
| RFC loans ............ | 29,939 | 63,670 |
| U.S.H.A. loans ........ | ..... | 53,493 |
| FEDERAL ............. | ..... | $86,532 |
| TOTAL CAPITAL.... | $575,287 | $679,126 |

### ENR INDEX NUMBERS

| Base = 100 | Construction Cost 1913 | 1926 | Building Cost '13 | '26 | Volume '13 | '26 |
|---|---|---|---|---|---|---|
| June 1938.. | 236.86 | 113.86 | 198.22 | 107.15 | ... | ... |
| May 1938.. | 236.80 | 113.83 | 197.86 | 106.95 | 167 | 73 |
| Apr., 1938. | 237.95 | 114.38 | 198.21 | 107.15 | 176 | 77 |
| June 1937.. | 237.25 | 113.80 | 199.20 | 107.85 | 246 | 108 |
| May 1937.. | 233.45 | 111.98 | 197.15 | 106.55 | 214 | 94 |
| 1937 (Av.). | 234.71 | 112.66 | 196.15 | 106.07 | 172 | 75 |
| 1936 (Av.). | 206.42 | 99.15 | 172.18 | 93.14 | 185 | 81 |
| 1935 (Av.). | 196.44 | 94.43 | 165.76 | 89.65 | 134 | 59 |





## THE MONTH'S SCOREBOARD

### ENR CONSTRUCTION VOLUME AND NEW CAPITAL . . . FHA MORTGAGES

| (,000 omitted) | May 1937 | 1938 | % Change | Five Months 1937 | 1938 | % Change |
|---|---|---|---|---|---|---|
| Total Construction............ | $235,012 | $183,806 | −22.0 | $971,029 | $1,031,865 | +6.5 |
| Private...................... | 125,283 | 56,997 | −55.0 | 494,180 | 438,343 | −11.0 |
| Public....................... | 109,729 | 126,809 | +16.0 | 476,849 | 593,522 | +24.0 |
| Federal...................... | 11,421 | 9,443 | −17.0 | 72,281 | 98,381 | +36.0 |
| Total New Productive Capital.. | $70,351 | $46,517 | −34.0 | $557,821 | $564,886 | +1.2 |
| Private Investment........... | 68,654 | 46,260 | −33.0 | 478,857 | 359,155 | −25.0 |
| Federal (non-federal work)..... | 1,697 | 257 | −85.0 | 78,964 | 119,199 | +51.0 |
| Federal (federal work)......... | .......... | ...... | ..... | .......... | 86,532 | ..... |
| FHA Mortgages Selected for Appraisal................. | $58,233 | $92,154* | +58.5 | $278,993 | $352,831* | +26.5 |

* *Preliminary Report.*

### CONSTRUCTION COSTS . . . WAGE RATES . . . PRICES

| | June 1937 | 1938 | % Change | Change May to June: 1937 May | June | % | 1938 May | June | % |
|---|---|---|---|---|---|---|---|---|---|
| *ENR* Construction Cost Index, 1913 = 100...... | 237.25 | 236.86 | −0.2 | 233.45 | 237.25 | +1.6 | 236.80 | 236.86 | 0 |
| *ENR* Building Cost Index, 1913 = 100............ | 199.20 | 198.22 | −0.5 | 197.15 | 199.20 | +1.0 | 197.86 | 198.22 | +0.2 |
| ***ENR 20-CITIES' AVERAGE*** | | | | | | | | | |
| Common Labor.......... | $0.644 | $0.677 | +5.1 | $0.627 | $0.644 | +2.7 | $0.673 | $0.677 | +0.6 |
| Skilled Labor (Av 3 trades) | 1.327 | 1.415 | +6.6 | 1.302 | 1.327 | +1.9 | 1.399 | 1.415 | +1.1 |
| Bricklayers.............. | 1.437 | 1.511 | +5.1 | 1.397 | 1.437 | +2.9 | 1.486 | 1.511 | +1.7 |
| Struct, Ironworkers........ | 1.343 | 1.460 | +8.7 | 1.342 | 1.343 | +0.1 | 1.488 | 1.460 | +0.8 |
| Carpenters.............. | 1.202 | 1.275 | +6.1 | 1.166 | 1.202 | +3.1 | 1.263 | 1.275 | +0.9 |
| Cement, per bbl .......... | $2.53 | $2.55 | +0.8 | $2.53 | $2.53 | 0 | $2.55 | $2.55 | 0 |
| Reinforcing steel, new billet | 2.90 | 2.86 | −1.4 | 2.88 | 2.90 | +0.7 | 2.89 | 2.86 | −1.0 |
| Structural Steel, Pittsburgh. | 2.25 | 2.25 | 0 | 2.25 | 2.25 | 0 | 2.25 | 2.25 | 0 |
| Sand, per ton ............ | 1.17 | 1.27 | +8.5 | 1.16 | 1.17 | +0.9 | 1.26 | 1.27 | +0.8 |
| Lumber, 2x4 Fir, per M ft.. | 38.31 | 31.49 | −17.8 | 38.35 | 38.31 | −0.1 | 32.32 | 31.49 | −2.6 |
| Lumber, 2x4 Pine, per M ft | 34.63 | 27.47 | −20.7 | 33.69 | 34.63 | +2.8 | 28.00 | 27.47 | −1.9 |
| Brick, common, per M..... | 14.20 | 14.14 | −0.4 | 14.15 | 14.20 | +0.4 | 14.14 | 14.14 | 0 |
| Ready-mixed concrete, c.y.. | 7.30 | 7.19 | −1.5 | 7.29 | 7.30 | +0.1 | 7.26 | 7.19 | −1.0 |
| Struct Clay Tile, 3x12x12.. | 74.05 | 73.74 | −0.4 | 73.81 | 74.05 | +0.3 | 73.76 | 73.74 | 0 |
| Paving Asphalt, cars, ton... | 17.27 | 16.05 | −7.1 | 17.32 | 17.27 | −0.3 | 16.24 | 16.05 | −1.2 |

### MATERIAL SHIPMENTS . . . BUILDING PERMITS

| | May 1937 | 1938 | % Change | Apr 1938 | % Change Apr-May |
|---|---|---|---|---|---|
| Lumber (% 1929 wk av) N.L.M.A............ | 76.5 | 56.4 | −26.3 | 56.3 | +0.2 |
| Steel (% operating capacity) A.I.S.I.......... | 90.8 | 30.2 | −67.0 | 32.4 | −6.8 |

| | Apr 1937 | 1938 | % Change | Four Months 1937 | 1938 | % Change |
|---|---|---|---|---|---|---|
| Fabricated Struct. Steel (A.I.S.C.) | 146,788 | 93,935 | −36.0 | 491,913 | 366,159 | −25.6 |
| Building Permits, Dun & Bradstreet (,000 omitted).......... | $117,599 | $84,842 | −27.8 | $393,059 | $362,318 | −7.8 |

### RENT INDEX . . . EMPLOYMENT

| | Apr. 1937 | 1938 | % Change | Mar. 1938 | % Change Mar.-Apr. |
|---|---|---|---|---|---|
| Rent (Housing) Index, N.I.C.B............ | 85.2 | 87.2 | +2.4 | 87.5 | −0.3 |
| Trade Unions, % Employed, A.F.L......... | 88.0 | 80.0 | −9.0 | 79.0 | +1.3 |
| Building Trades, % Employed, A.F.L....... | 73.0 | 60.0 | −17.8 | 56.0 | +7.1 |

# TVA Investigators Hear Directors

**Congressional investigation begins with statements by the two Morgans and Lilienthal**

Investigation of the internal troubles of the Tennessee Valley Authority by a special committee of Congress began on May 25 when Arthur E. Morgan, deposed chairman, was called to the stand to amplify the charges that he made in March against the other two directors, Harcourt A. Morgan and David E. Lilienthal. The two latter directors were given a similar opportunity two days later to state their views with respect to the chairman's charges, after which the hearings were adjourned to permit study of the statements.

### Dishonest administration

Arthur Morgan in his opening statement made it clear that he did not and never had charged the other two directors with "having taken bribes or stolen money" but with "other and more subtle forms of failure to meet a public trust which are no less a menace to good government". Specifically he charged the following:

1. Inaccurate and misrepresentative reports to the President, the Congress and the public.
2. Mismanagement of the power program.
3. Lack of candor in statements to the Congress and the public concerning the power program.
4. Improper and misleading accounting, reporting and publicity in reference to the "yardstick".
5. Collusion, conspiracy and mismanagement in administration.
6. Subservience to political and other special interests.

Included in his detailed amplification of the charges, in addition to the details of the now famous Berry marble case, was a charge that Director Lilienthal had deliberately set out to create an impression in the minds of Congress and the public that the Commonwealth & Southern Power Corp. was much more hostile to the TVA power program than is actually the case. In another instance he charged Lilienthal with having deleted from board minutes sections that indicated willingness on the part of the power corporation to negotiate with the TVA for the sale of some of its properties. This section included a statement that Lilienthal had asked Secretary Ickes, PWA Administrator, for immediate action on PWA loans to the towns of Tuscumbia and Sheffield for acquisition of the municipal systems in view of the corporation's willingness to sell.

Arthur Morgan sharply criticised Lilienthal for having set so-called "yard-stick" power rates without action by the full board. He charged Lilienthal and H. A. Morgan with having agreed to an unpublished plan under which such rates were based on hidden subsidies. Sales promotion costs were not included, he said, and the TVA had contributed legal, accounting, engineering and general organizational aid to the TVA power communities without making those facts known to the public.

In figuring power costs, Morgan said, the other two directors had refused to approve his plan for dividing joint costs such as dams and reservoirs between power, flood control and navigation substantially in proportion to the value each received. Lilienthal favored treating power as a by-product bearing no part of dam and reservoir costs. This Arthur Morgan held to be a subterfuge.

### Counter charges

The statements by Harcourt Morgan and David Lilienthal were chiefly counter-charges to the effect that Arthur Morgan had continuously obstructed the other two directors in carrying on the work of the TVA after they had refused to agree to a plan under which the board would take no action except by unanimous vote, a system that would have given him veto power over any proposal of the other two. In the Berry case Lilienthal stated that Arthur Morgan's unprecedented action in appearing as a witness had greatly interfered with the work of the TVA legal division.

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# PWA Gives Consent To Utility Purchase

Tentative approval of the proposal to create a state-wide public power system in Nebraska through the purchase of ten private utility companies by three public power and irrigation districts has been given by the Public Works Administration in a letter to the three districts signed by H. A. Gray, assistant administrator. Mr. Gray expressed the willingness of PWA to modify existing loan contracts so as to permit the necessary financing.

As already noted (*ENR*, May 19, 1937, p. 700) the Platte Valley, Central Nebraska, and Loup River public power districts plan to issue additional bonds to the amount of $20,865,000 in order to purchase outright ten private utilities now serving approximately seven-eighths of the area, but only one-third of the consumption, of the state. Eventually it is hoped to acquire the three large utilities that serve the heavily-populated eastern section.

# Identical Bids on Cement For Reclamation Bureau

Three identical bids were receiv by the Procurement Division of t Treasury May 26 in answer to its r quests for quotations on 5,000 barr of finely-ground standard portland c ment to be used by the Bureau Reclamation in New Mexico. In th case, bids were asked f.o.b. point delivery with delivery to be spre over a 10-month period.

The three companies bidding we Colorado Portland Cement, Southwe ern Portland Cement, and U. S. Po land Cement. Each bid $2.50 per bb in cloth bags, less 10 cents per barr discount for payment within 15 da of delivery and with 10 cents allo ance for returned bags.

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# New Jersey Governor Urges Delaware Water Plan

A proposal to meet the need for a new supply of water in northern New Jersey communities by drawing water from the Delaware River through the Delaware-Raritan canal was made by Governor Moore of New Jersey in a mesage to the state legislature May 24.

The governor's proposal contemplated drawing about 150 m.g.d. from the Delaware River above Stockton and conveying it through the canal to a reservoir to be constructed near Bound Brook. The water would be treated at the outlet of the reservoir and conveyed in conduits to the water distribution systems of communities in the area. The plan is estimated to cost about $28,000,000.

The governor suggested that the legislature create a state water authority with broad powers to carry out the plan as a self-liquidating project.

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# New York Gets WPA Money For Mosquito Control

WPA allotment to the city of New York of $2,540,000 for control and eradication of mosquitoes in low-lying parts of the city has been approved by the President.

Under this project, about 8,150 men will be kept busy for six months digging ditches and building retaining walls and dikes in swamps and around ponds.

It is planned to do about 35 per cent of the work in the borough of Queens, particularly around the 1939 World's Fair area, about 20 per cent in Brooklyn, and 20 per cent in the Bronx. About 18 per cent of the work will be done in Staten Island.

# Buffalo Ex-Mayor Is Convicted

### Guilty of bribery but not convicted of bribing engineers seeking contract on sewer project

Former Mayor George J. Zimmermann, Buffalo, N. Y., was convicted, May 25, on six counts of an indictment charging him with soliciting and receiving illegal fees in connection with the $15,000,000 sewer project in that city. He was acquitted on two other counts in the same indictment, the first of which charged him with asking $200,000 in September, 1935, from Fred G. Cunningham, president of Fuller-McClintock Engineering Co., New York City, for appointment as engineers of the project, and the second count which charged him with agreeing about Nov. 1, 1935, to accept $100,000 from Fuller-McClintock in installments in return for giving that firm the engineering contract on the project.

### *Bribe receipt charged*

The six counts on which the jury convicted the former mayor related to an alleged agreement with Frank E. Seymour, president of F. E. Seymour, Inc., insurance firm, to coerce and persuade contractors on the sewer project to place their insurance with the Seymour company. The indictment specified dates and payments, totaling $6,400, which the Seymour firm made to the former mayor. These may involve penalties of not more than ten years imprisonment or a $4,000 fine or both for each count. Attorneys for the former mayor have announced that they will appeal the conviction to the higher court.

The trial culminated a period of political turbulence which started in June, 1935, when a federal grant of 45 per cent was secured for the sewer disposal project which was to be built by the Buffalo Sewer Authority, a body created by an act of the state legislature and whose members were appointed by the mayor. Controversy centered on the choice of engineers for the project, the original candidates being Clyde Potts and Fred Cunningham, of Fuller & McClintock. Cunningham eventually was appointed engineer by the authority but the action was later rescinded, and Potts was designated. Cunningham testified at the trial that he concluded he would have to pay for the engineering contract if he received it. His contact man in Buffalo, Joseph H. Acheson, an engineer, testified along lines similar to Cunningham's.

After Potts was designated as engineer by the sewer authority, his appointment was held up and eventually cancelled by Secretary of the Interior Ickes. Greeley & Hansen, Chicago engineers, finally were appointed and carried through the project, which will be completed and in operation in a few months.

### *Accused previously*

Before this trial was held, former Mayor Zimmermann had been the center of another controversy over the sewer project. In the fall of 1935, demands were made on Governor Lehman for the mayor's removal from office because of an affidavit filed by Acheson in connection with sewer matters, but the governor declined to act on the ground that nothing had been placed before him to justify executive action. Shortly afterwards a federal grand jury began an investigation of the sewer project but failed to indict anyone after two days deliberation on the case.

### *Municipal investigation*

Zimmermann's present conviction arose out of an indictment returned by an extraordinary grand jury on March 14, 1938, following an investigation begun by Frank G. Raichle, Buffalo lawyer, who was named special prosecutor in December, 1937, and conducted a sensational investigation of city affairs, which touched upon matters relating to the sewer system.

Wide World Photo

NEW FEDERAL JAIL ON COAST

FORMAL opening of a new federal jail on Terminal Island at San Pedro, Calif., took place May 26, putting into operation the twentieth institution in the federal prison system.

The jail will be used to house about 600 male and 24 female prisoners under sentences of less than 18 months. The buildings are of the self-enclosing type, so there is no wall about the institution. As may be seen above, the cell block surrounds an exercise yard. Los Angeles harbor is visible in the background.

# Professional License Pushed In Louisiana

With the sponsorship of the Louisiana Engineering Society, a bill was introduced into the state legislature May 19 which would substitute a general professional engineer's license for the civil engineer's license now required under Louisiana law.

The new bill would require a board of examiners to issue licenses in professional engineering and in land surveying. Alternative requirements for the license would be graduation from an engineering school and four years experience, eight years experience and an examination, or, during the next five years, twelve years of experience. Engineers practicing at the time of passage of the act would be eligible to receive a license, and present holders of civil engineering licenses would automatically receive professional engineer's licenses. The bill closely follows the provision of the model law.

Some opposition to the new bill, apparently in an unorganized form, is being expressed among Louisiana civil engineers. It is asserted that the new bill would admit a considerable body of now unlicensed men to competition with licensed civil engineers. Those in opposition point out that of 543 licensed civil engineers in the state, only 117 are members of the Louisiana Engineering Society and not all of the practice civil engineering.

## *BRIEF NEWS*

MUNICIPALLY OWNED lots are being sold by the city of Long Branch, Ont. at $10 each, if the purchaser will agree to erect a house costing at least $2,500 within two months. The city is selling 583 lots.

TEST HOLES 3 ft. in diameter were sunk to a depth of 147 ft. in making borings for a proposed flood-control dam on the White River near Buckley, Wash., on which plans are being drawn up by the U. S. Engineers. It is planned to build a $4,000,000 concrete structure 400 ft. high and 800 ft. long in a deep gorge near the river's source.

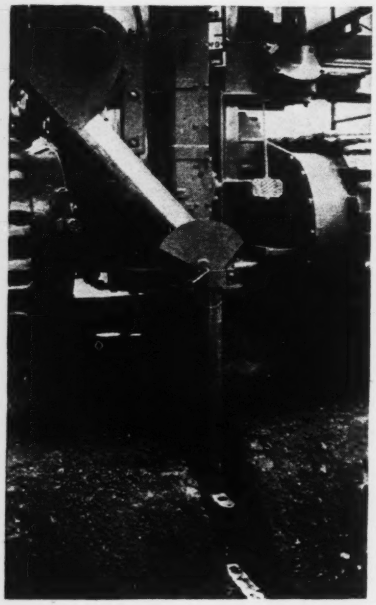
MOTOR VEHICLE registrations in the United States in 1937 totalled 29,705,000, an increase of about 1,539,000 over 1936, according to the U. S. Bureau of Public Roads. Automobiles accounted for 25,406,000 of this number, trucks for 4,255,000, and buses 44,196.

VOTERS of the Oxnard, (Calif.) Harbor District in Ventura County approved a $1,750,000 bond issue for construction of a harbor at Hueneme. It will be constructed at a site where there is now no harbor; a deep submarine valley approaching almost to the shore line and an expanse of easily excavated sea-level salt marsh led to the choice of the location. Although an application for PWA assistance has been approved, construction will not wait for receipt of federal funds, since the bond issue is large enough to cover the entire cost of the project.

THE GRAND RIVER DAM AUTHORITY has filed an application with the Federal Power Commission for a license for the Pensacola hydro-electric project. The project includes a multiple arch dam rising about 147 ft. from bed rock in the Grand River; a 1,680,000-acre-ft. reservoir; and a power house with an initial installed capacity of 80,000 hp.

GLASS REFLECTORS are being mounted on white posts at 100-ft. intervals along the roadway shoulder on several short experimental sections of Southern California highways. The installations, similar to those being studied in Michigan, are being made by the Automobile Club of Southern California.

DURING the March floods in southern California, rain fell in unprecedented quantities on the desert regions, and a 26-sq.mi. lake was formed near the southern end of Death Valley by the overflow of the Mojave River. Although percolation is very slow in that region, due to the high percentage of chemicals in the soil, it is expected that evaporation will remove the lake within two years. Meanwhile it is being used for motor boat racing and other aquatic sports, a novelty in the Colorado desert.



DRAIN PIPE FORMED IN GROUND

POROUS concrete pipe for agricultural and other drainage work is formed in place in the ground by the *Rohrpflug* or "pipe plow," a new German device exhibited at the Leipzig fair.

Mounted on a crawler tractor, the plow opens up a furrow and forms the pipe at the bottom of the furrow by extrusion of a dry concrete mix through a die.

THE COST of the proposed concrete pontoon bridge across Lake Washington at Seattle has been estimated at $2,945,000 by state highway director L. Z. Murrow. The total cost of the project, including a tunnel in Seattle and approach structures, would be $5,671,000. Murrow estimates that a fixed bridge at the same location would cost four times as much.

FURTHER FUNDS for the Bayonne, N. J. port terminal will not be released by the Public Works Administration until the city justifies reductions in the scope of the project, PWA has announced. There is also some doubt whether the Central R.R. of New Jersey will carry out an agreement to build tracks at the site.

THE METROPOLITAN Water District of Southern California has made an agreement with the Reconstruction Finance Corp. whereby RFC will accept refunding bonds bearing an average interest rate of $4\frac{1}{8}$ per cent in exchange for $200,000,000 in 5 per cent Colorado River aqueduct bonds already sold the RFC. RFC has been rebating 1 per cent of the interest charges to the district since April, 1934, but its agreement to do this expires early next year.

A HIGHWAY bond issue of $5,000,0 has been approved by the Mexic legislature. It is understood that the greater part of the proceeds will be used in construction of the Mexi City-Nogales and Mexico City-Suchia highways and for improvements to the highway between Mexico City and Acapuleo.

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## *New Classification Added In Bridge Competition*

Movable bridges will be eligible to compete in the American Institute of Steel Construction's annual competition for beautiful bridges under a new classification introduced in the contest for bridges opened in 1937.

In addition to the three classification hitherto used, A.I.S.C. announced a classification including movable bridges of any type or cost will be included. The other classifications are bridges costing more than $1,000,000; bridges costing less than $1,000,000 and more than $250,000; and bridges costing less than $250,000.

Photographs of all bridges to be submitted in the competition must be received by the institute, 200 Madison Ave., New York City, by June 11. Announcement of awards will be made next month. The jury in this year's competition consists of Prof H. E. Wessman, New York University; William H. Yates, consulting engineer; L. Andrew Reinhard, architect; William Lescaze, architect; and Kenneth Reid, managing editor of *Pencil Points*.

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## *Revenue Bonds Upheld By State Court*

*Continued from page 761*

culiarly in the interest of the public.

"Because of the fact that most cities and towns are so largely indebted that they cannot acquire and pay for extensive utilities out of their general revenues, or by bonds within their constitutional limits of debt, the special fund rule offers the only means of relief from helpless dependence upon an exclusive private market."

Moreover, the court held, it is not necessary in the case of a project financed by bonds secured only by revenues from the proposed plant and not pledging the revenues of the city, for the city to advertise for bids or budget the expense,

## *Conference on Structures To Be Held This Month*

A summer conference on structural practice sponsored by the civil engineering division of the Society for the Promotion of Engineering Education and by the Armour Institute of Technology is to be held in Chicago June 20-30. The conference, the first of its kind to be held by theS.P.E.E., is the outgrowth of a suggestion made last year by Dean F. W. Garran of Dartmouth College; it proved impossible to hold it last year, and it was again suggested this year.

Each day of the conference will be sponsored by an organization or company in the Chicago area. Thus, on June 20, the morning will be devoted to papers by representatives of the Portland Cement Association, and the afternoon will be devoted to an inspection trip to examine concrete construction in the neighborhood. The American Bridge Co. will furnish the papers and inspection trip for the second day, and Chicago Bridge & Iron Co. for the third day. The last day will be more miscellaneous in its nature, but will largely be devoted to steel bridge construction.

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## *Ontario Threatens to Halt New Falls View Bridge*

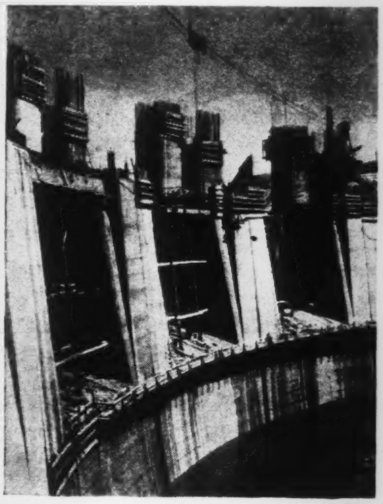
As the International Ry. Co. began work on reconstruction of the Falls View Bridge over the Niagara River which was pushed out by ice last January (*ENR*, May 26, 1938, p. 735), Premier Hepburn of Ontario announced that his government was determined to halt construction of the bridge by a private company. "The day of privately owned owned bridges is past," he said. "We have authority from Ottawa to build a bridge, and a similar bill is making good progress in the United States Congress. In the meantime, we have legislation to prevent these plans for a privately owned bridge. . . ."

Meanwhile, International Ry. announced details of their reconstruction plan. The new bridge will be a spandrel braced arch 950 ft. long, 110 ft. longer than the old bridge. It will carry a 42-ft. four-lane roadway with a surface consisting of a concrete-filled I-beam grid.

The bridge is designed to have a capacity of 1,600 vehicles per hour in each direction, and eleven inspection lanes will be provided at each end so that inspection facilities will be equal to the full capacity of the bridge.

A 12-ft. sidewalk for pedestrians will be provided on the upstream side of the bridge at a level lower than that of the vehicle deck, thus permitting an unobstructed view of the falls for both pedestrians and passengers in vehicles.

A contract for preliminary work on the foundation has been let, but no contract has been let on the main bridge.



*Bureau of Reclamation Photo*

PARKER DAM NEARS COMPLETION

Now in the final stages of construction is Parker Dam on the Colorado River, 150 miles below Boulder Dam. Unusual in its design in that the dam structure reaches down 235 ft. below the river bed, the dam will create an intake reservoir for the Colorado Aqueduct of the Metropolitan Water District of Southern California. Shown above are the downstream side of the spillway openings, the piers, bridges and columns.

The dam is being built by the Bureau of Reclamation with funds furnished by the water district.

## *Quebec Power Body To Build Plant*

Premier Duplessis of Quebec has announced that the National Electricity Syndicate will undertake construction of a water power plant in north-western Quebec to provide for mining properties being developed in that region. The decision follows a study by the syndicate. Some details are still in doubt, difficulty having arisen in particular from the fact that both 60 cycle and 25 cycle power is now being used in the district.

The National Electricity Syndicate is a provincial body set up last year by the Quebec legislature and authorized to receive an initial capital of $10,000,000 from the provincial government. It can either construct its own projects with government funds or cooperate with private companies (*ENR*, Dec. 9, 1937, p. 961).

# WASHINGTON HIGHLIGHTS

*Special reports by Paul Wooton*

HIGHWAY OFFICIALS of three eastern states conferred in Washington May 27 with Rep. Drew of Pennsylvania to consider problems relating to the proposed superhighway between Washington and Jersey City, N. J., which eastern congressmen are backing as a demonstration of the self-liquidating possibilities of this type of road. Citing as an example the $65,000,000 toll highway to be built along an abandoned railroad right-of-way between Harrisburg and Pittsburgh, Pa., Rep. Drew suggested that the four states concerned investigate the legal possibility of following this pattern in building each state section of the proposed superhighway and of financing construction through state bond issues and federal work-relief grants.

The meeting was attended by Samuel W. Marshall, chief highway engineer of Pennsylvania, W. W. Mank, Delaware highway engineer, and Nathan L. Smith, Maryland highway engineer.

PRESIDENT ROOSEVELT has signed a bill authorizing Suffolk County, N. Y., to construct and operate Long Island loop toll bridges over water surrounding Long Island.

THE STATE of New Jersey on May 23 petitioned the U. S. Supreme Court to reopen a case decided in 1934 concerning the boundary line between New Jersey and Delaware. The brief states that new evidence dating back to 1683 has been uncovered and should be considered.

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## *Wisconsin Hydro Plant Goes Out in High Water*

A fifteen year old dam on the Wisconsin River at Brokaw, Wis., about five miles north of Wausau, was carried out by high water on May 29. When the dam went out, it carried away a $700,000 hydro-electric plant and three gates. The crew manning the plant was warned by a settling movement of the structure and barely escaped. Down river dams were warned of the approaching surge, and damage to them was prevented.

The dam, owned by the Wausau Paper Co., was 800 ft. long and 28 ft. high. Failure is attributed to the high water resulting from spring rains and weakening of the foundations by erosion.

# *COMMENT AND DISCUSSION*

*Readers' opinions on matters that concern the engineer*

## Water in the Desert

Sir: The article describing the ingenious method of obtaining water in the desert regions of Baluchistan, India, by means of underground channels which tap natural storage basins (*ENR* Mar. 3, 1938, p. 327) was of considerable interest to me because much the same scheme has been widely used in Syria. Climatological and rainfall conditions in Syria being about identical with those in Baluchistan, water is likewise a very precious fluid in our country. This fact obliges every farmer in most parts of this country to do his utmost to profit from every drop of available water.

In Syria, at the present time, there are over a thousand of these *karezes* (or *kanayets* as they are called in Arabic). They were dug in different epochs, some of them dating 2,000 years back and even more. Although the tunnels have been in most cases constructed in solid rock strata (tertiary limestone mostly) most of the *kanayets* became filled with earth and silt. Consequently, all traces of them were lost for generations. It is only during the last two decades that farmers everywhere in the country and in the desert regions particularly, began their hunt for these long lost and buried water canals.

The *kanayets* in Syria have a cross-section of about 2 x 5 ft., a slope varying between 2:10,000 and 1:500. As to depth and length, I have inspected a few that were over 150 ft. deep and as much as 8 miles in length—this enormous length necessitating the existence of over 200 shaft-wells.

The tunnel is often protected by masonry in places where the occurrence of internal earthfalls is probable. In a few instances, the sides and floor of the tunnel are lined with a kind of natural cement, a precaution taken to minimize water loss. Generally the *kanayets* have more than one branch, the branches running almost at right angles with the main drain or collector, thus intercepting all possible circulation of water in the valley. The discharge of these systems varies between ¼ and 4 sec. ft.

A very remarkable thing that attracted my attention in some of the oldest *kanayets* unearthed recently is the existence of traces of ancient flour mills along the main collector. These mills were entirely underground and operated by the water flowing through the canal. In the vicinity of *kanayets*, there may be seen small hills made of earth, hemispheroidal in shape, their height ranging between 30 and 50 ft.; the base of these hills covers an area of about 150x250 ft. I am led to believe that those hills were formed from the earth and rock excavated from the tunnels and were once used as fortresses thus enabling the owners to defend their water supply.

The Syrian farmer appreciates the vital importance of his water canal and keeps it clean and in good condition. These maintenance operations are usually undertaken late in spring. In spite of the fact that modern water-lifting devices are available, the land owners are very reluctant to adopt any new method for obtaining underground water. Low cost upkeep and cheap labor in Syria maintain the popularity of the *kanayets*.

SADIK BAROUDI
*Service Hydraulique*
*Damas, Syria*

## Montreal Bridge Design

On page 702 of the May 19 issue, the news report of the death of J. B. Strauss refers to a number of bridges designed and built by him and his firm, including the St. Lawrence River cantilever bridge at Montreal, the latter being designed in conjunction with Monsarrat & Pratley, "Canadian consultants." It has been called to our attention that the wording of this paragraph would intimate that the designing of this bridge was done by Mr. Strauss. As a matter of fact the designing and supervision of construction was carried out by the firm of Monsarrat & Pratley of Montreal, with Mr. Strauss as associate engineer.

## Defective Brick Specifications

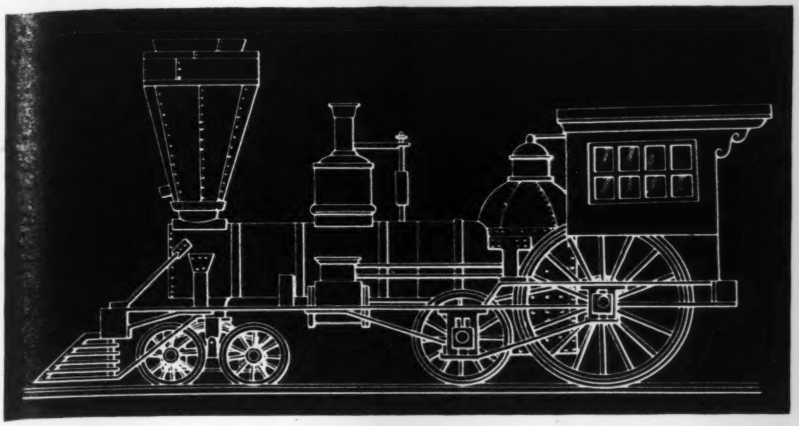
Sir: Some time ago your pape carried some discussion of difficulties in connection with brick copin walls in the Locke Field Apartments a PWA project in Indianapolis. Thi discussion gave no attention to on of the chief causes of cracking i modern brick wall, namely, defectiv specifications for the brick and th mortar. Specification writers ar calling for compressive strength qualities that are seldom required. As a result the walls built today shear and crack under horizontal pressures set up by temperature.

The specifications as written today require that the brick wall be slushed full; another fallacy in trying to build a satisfactory brick wall. Slushed work has but one quality that of strength—seldom needed. It creates a capillary attraction and holds moisture rather than repels it. A brick wall slushed full with a mortar largely of portland cement will effloresce much more than a similar wall built with lime mortar.

The better houses built in the residential sections near Boston are largely of brick veneer on wood. Efflorescence is seldom seen on this type of brickwork as there is little if any slushing done although the same class of mortar is used as was used in the better buildings using structural brick walls.

The open air space or vaulted brick walls such as were built before synthetic mortars were heralded into use, were the result of bricklayers experiences over centuries, and when most bricklayers were taught why he did, thus and so, under a rigid apprenticeship system. There is no real apprentice system today; the "bricky" picks up the manipulation of the tools as opportunity presents itself and is told to slush up the wall because the specifications call for the work to be done that way.

The matter of bond through the wall has been technitioned into five courses between headers instead of nine. A brickwall with headers every tenth course will not fail unless failure of foundation occurs. Headers in exterior course make a wall of more capillary attraction than a wall built using snap headers and metal ties, regular bond and wall ties or regular bond back-



The "Governor Paine" as built in 1849.

snapped and brick-bonded. Mortar should be flexible, adhesive and tough enough to withstand the weather during the anticipated life of the structure, but when synthetic cementing materials have been added in sufficient quantity to make a mortar of the required compressive strength the addition of more only tends to make a brittle non-elastic hard-working mortar that has no place in making a satisfactory exterior masonry wall of either brick or stone.

JAMES A. MUNROE
*North Attleboro, Mass.*

## High Railroad Speeds

Sir: The letter from William P. Snow in your issue of April 23, p. 609, interested me as I too was a boy in Vermont and was familiar with the Central Vermont R.R.

I enclose a drawing of the famous locomotive "Governor Paine", along with the following extracts from the account of it given in a Baldwin Locomotive Works catalog dating from about 1872:

"Early in 1848, the Vermont Central R.R. was approaching completion, and Governor Paine, the president of the company, conceived the idea that the passenger service of the road required locomotives capable of running at very high velocity. He offered Mr. Baldwin $10,000 for a locomotive which could run with a passenger train at a speed of 60 m.p.h. Mr. Baldwin at once undertook to meet these conditions. The work was begun early in 1848.

"The engine was completed in 1849 and was named the 'Governor Paine'. It had one pair of driving wheels 6½ ft. in diameter, placed back of the fire box. Another pair of wheels, but smaller and unconnected, was placed directly in front of the fire box, and a four-wheeled truck carried the front of the engine.

"The 'Governor Paine' was used for several years on the Vermont Central, and then rebuilt into a four-coupled machine. During its career, it was stated by the officers of the road that it could be started from a state of rest and run a mile in 43 seconds. Three engines on the same plan were also built for the Penn. R.R. in 1849. They weighed each about 47,000 lb. A speed of four miles in three minutes is recorded for them."

From this quotation it will be noted that high speeds were achieved, not "shortly after the Civil War" as Mr. Snow heard, but in 1849-1851, ten or twelve years *before* the war, or nearly ninety years ago.

Charles E. Crane, author of "Let Me Show You Vermont" has therein recorded that there was intense rivalry between the Vermont Central, chartered in October 1843, and the Champlain & Connecticut River, (later the Rutland & Burlington) incorporated in November 1843, to be the first to complete a railroad to connect Burlington on Lake Champlain with Boston. The Vermont Central was beaten by two weeks in the race for completing the track connection; but, thanks to Governor Paine's forethought, it had an ace up its sleeve in the locomotive named for him, built to snatch the speed laurels in competition for the Burlington-Boston passenger and mail traffic. The English mail contract between Montreal and Boston, mentioned by Mr. Snow, might have been still another prize for the speed competition that Governor Paine had in view when he ordered this engine; but in 1849, when both rival roads were opened for traffic *south* from Burlington, there was no physical rail connection in existence *north* of Burlington towards Montreal. The original Vermont & Canada R.R., chartered in 1845, which met the Vermont Central line at Essex Junction, 8 miles east of Burlington, was not then finished; it was completed to St. Albans in 1850, and to Rouse's Point, N. Y., in 1851, where it finally joined the Champlain & St. Lawrence R.R. that had previously been built to link Montreal with Lake Champlain steamboat traffic.

As this railroad situation had been highly competitive from its very inception, it is evident that the "Governor Paine" was built to win just such a speed race as that described by Mr. Snow; but if the prize was the Montreal mail contract, this particular race probably did not occur until 1851 or later, a few years after the engine had been placed in service.

It has always been a wonder to me that with such a light engine, and the light iron rails and flimsy rail-joints then in vogue, a train could "stay on the iron" at all, at 60 to 75 miles per hour.

W. NELSON SMITH
*Reading, Pa., May 13, 1938*

## Granite & Terra Cotta

Sir: In the May 19 issue of Engineering News-Record, on page 708, you show a picture of the new 17-story federal building and post office now in the process of construction in Los Angeles. Underneath the photograph you state that this building is granite-faced. In the interest of accuracy, we beg to advise, that this 17-story structure has only a granite base course. Above the base course the construction is all of machine-made terra cotta. There are approximately 2,500 tons of terra cotta in this project.

The federal post office building in Los Angeles is one of the outstanding terra cotta jobs on the Pacific Coast and we regret that it was not so reported.

J. J. STEIN
*Executive Secretary*
*Clay Products Institute of California*
*Los Angeles, May 23, 1938*

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*JUNE 2, 1938*

INQUIRY into the TVA by a joint Congressional committee has begun, and there is prospect at last that some light will be thrown on the history and difficulties of the remarkable national experiment in developing a river basin. Already it is apparent that the central issue will be the government's ability to manage a creative enterprise in businesslike manner and in harmony with public obligations. The mutual accusations of the directors paint an initial picture of administrative failure, of personal intrigue, of falsification of records, of sharp business practice, and of the paralysis of coordinated managerial thinking. The administrative competence of public agencies is placed under direct challenge by these accusations. If the best that can be done in public management is represented by the doings of the ex-college presidents and ex-public regulators on the Tennessee Valley Authority we ought to confess bankruptcy of business sense and responsibility in the field of public administration. The further proceedings of the hearings will doubtless give more precise information on this point. It is to be hoped that they will show exceptional personal defects to be responsible, rather than national incompetence in public administration.

## *Plan in Sight*

A PLANNED ROAD SYSTEM may at last be looked forward to, as a result of the highway inventory and traffic survey an account of which begins in this issue. No such possibility has existed heretofore. In the twenty years in which our network of modern roads has been carried to new boundaries by hundred of thousands of miles, system planning has existed only in respect to federal-aid roads. So-called state-road systems have shifted and changed according to legislative whim and impulse, and the vastly larger mileage of secondary and tertiary road has eluded all attempts at building into a system. No one has had the necessary knowledge of mileage, character, condition, traffic use or potential tributary sources of use of these other roads that would make system planning possible. The survey now in progress is providing this knowledge. In volume and detail of factual information it goes far beyond the range of basic data ever before acquired for any class of public works. Actual system planning is the next step forward.

## *Filling on Muck*

BUILDING A FILL on soft ground at North Beach airport represents a new application of soil mechanics principles, and on present results a highly successful one. Millions of yards of ashes and refuse are being dumped over 200 acres of underwater muck 70 ft. deep by methods planned to reduce mud waves to a minimum. Calculation indicated that truck dumping on a flat slope of 35:1 would be feasible, and so it has proved; mud waves have not been serious so far, though of course some movement of mud is inevitable. The critical part of the work is yet to come, for as the fill progresses the water gets deeper and the flat slope becomes more difficult to maintain. On the other hand, the fact that settlement of the fill into the muck has been less than contemplated is encouraging, for it shows the soft silt to have greater bearing value than was judged from surface indications. The further progress of this bold grading operation should add still more to knowledge of soft-ground filling.

## *A $2,500,000 Swat*

ALWAYS DOING things in a big way, New York City is now ready to embark on the largest anti-mosquito campaign ever undertaken at one time. Financed with WPA funds amounting to more than $2,500,000, the campaign will provide work for 8,000 men during the next six months. It is true that mosquito control is not a new venture for New York municipal authorities; such operations have been carried on since 1905 and a well-qualified organization has been developed to handle the work. But funds have never been adequate, and with 22,000 acres of salt marsh inside the city limits and some 60,000 catchbasins as potential breeding places the health authorities have properly been concerned with the mosquito menace. By securing a generous federal allotment for abatement operations the city will solve two problems, namely, putting unemployed men on useful work and advancing a well-deserved health measure. The 33 c. per capita that will be spent on the campaign will thus do much more than eliminate a good many of the midsummer swats which the 7,500,000 inhabitants normally administer.

## *Spry and Lazy Salmon*

BONNEVILLE'S costly fish ladders and fish elevators are being put to their first test and are reported to be working successfully. Spry fish are going up the ladders with ease and agility, while the more indolent ones seek out the elevators and go up to the upper pool in comfort and with surprising nonchalance. All of which appears to indicate that the grave fears of the fish experts whose insatiable demands for more and different fishways increased the cost of fishways to $6,500,000 were unfounded. It is now evident that much less elaborate facilities would have proved adequate. Nor will the young salmon coming back down to the sea suffer any harm, judged by experience in Scotland reported in this issue. A valuable experiment now becomes possible: By taking the fishways at Bonneville out of service progressively it should be possible to determine how many fishways are required and what type and size are best. This should make possible a reduction in expenditures for fishways at other dams farther up the Columbia, and for that matter on other salmon rivers.

## A Look Back

TWENTY YEARS AGO the concept of a paved road from ocean to ocean was so novel as to capture the imagination. For this reason the 3500-mile Lincoln Highway became front page news; processions and celebrations signalized the surfacing of each new section. A few days ago, when the papers noted briefly that all but 42 mi. (now under construction) of the Lincoln Highway had been surfaced with something better than gravel, no one but a few old timers gave the news a second thought.

Yet in its generation the Lincoln Highway was a bold example of progressive highway thinking. Its inception therefore is an undertaking that deserves a definite place in the highway history of America. This is true despite the fact that the highway progress of a quarter of a century makes it a little hard now to think of the Lincoln Highway as great. By present standards its location is indirect, the line and grades are hazardous, its widths are inadequate and much of its paving hardly deserves the rank of good modern secondary road surfacing.

In appraising what this early product of a new enthusiasm for human communication signifies, we must return to the viewpoint of an earlier road-building age. Then the picture seen, the vision of the first transcontinental road planners, becomes sharper and bolder. In their day paved roads in the old states of the East were few and interstate paved routes were scarcely considered. Over vast mileages of western plains and mountain states, surfaces better than the roadside materials did not exist. A paved road across any state was a high ambition when the Lincoln Highway was planned as a paved road across a continent. It promised to create new ties to strengthen the nation's unity. The very thought was stupendous!

In the light of the transcountry gridiron of superhighways proposed by federal legislators in recent months the Lincoln Highway looms small. As a modern highway structure it is surpassed by hundreds of miles of paved road being constructed every year. But it pioneered a plan for ocean-to-ocean road transport as bold as those of the transcontinental railroad builders, and its completion is an accomplishment that spreads credit on the many communities and individuals that had a part in the great labor. Let it have this award of memory.

## Federal Competition

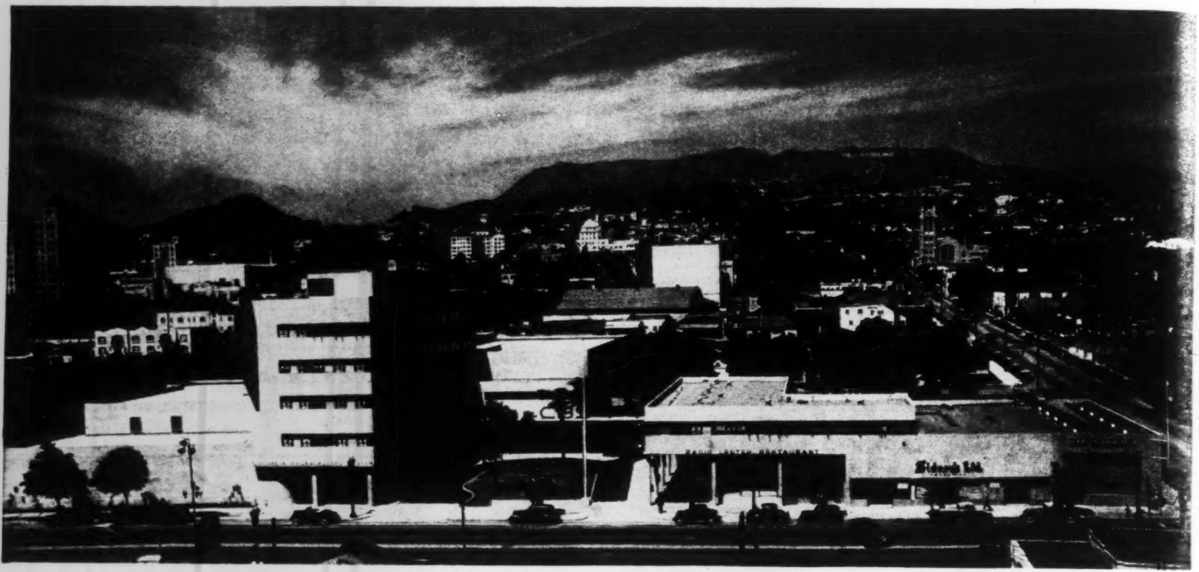
A DEFINITE MOVE on the part of a federal bureau to take over work that should be done by private consulting engineers is cited by American Engineering Council in the April issue of its Bulletin. The Federal Power Commission has undertaken to "make a preliminary estimate of the cost of an electric distribution system for the city of Fort Worth, Texas, and a forecast of the power requirements of that city for the next decade". The commission justifies this excursion into the field of practice of the consulting engineer by stating that under the statutes creating and expanding the powers of the commission it is required to assist agencies of the federal government or those financed with federal funds in the consummation of their objectives.

Without doubt there are provisions in the Federal Water Power Act that can be interpreted as authorizing the commission to make an engineering study for the Colorado River Authority, for the act now amended is very broadly and loosely worded. But to carry the interpretation of loose wording to the point of holding that it authorizes the commission to make a study for a possible client of a federally financed undertaking is to pass quite beyond the limits of logic.

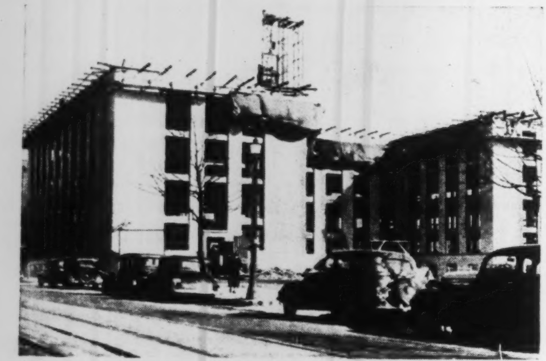
This is a definite entry by the power commission into competition with engineers in private practice, despite the statement of the chairman of the commission that it has no intention of so doing. The facts deny the chairman's declaration made in answer to the protest of American Engineering Council. The engineering profession should record its objections to this new activity on the part of the commission in the strongest possible terms. If necessary it should seek a court injunction against expenditure of federal funds for such a purpose.

The Federal Power Commission has definite and logical fields for engineering studies, such as national power resources and power use, in which few will question its right to act. But when the commission attempts to go beyond national fields it should be strongly resisted lest it gradually take over activities that are the rightful province of the consulting engineer.

# PICTURES IN THE NEWS

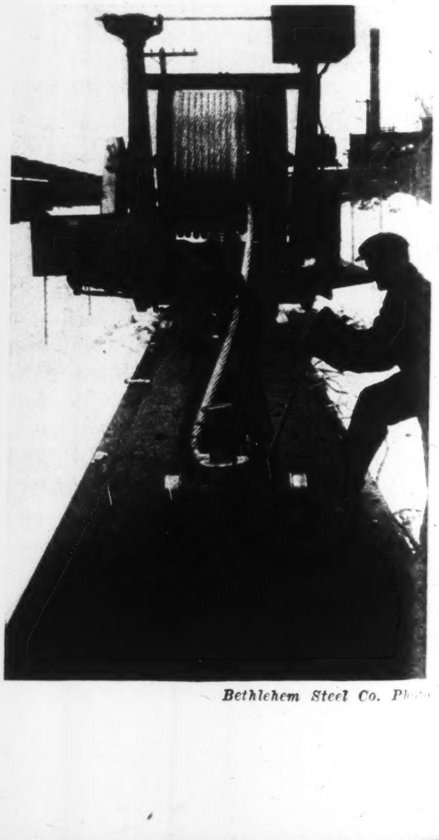


*RADIO INVADES HOLLYWOOD, first hiring its movie stars and now changing its skyline by a striking group of buildings to house Columbia Broadcasting System's station KNX. Left to right along the block, which Hollywood maps designate as Columbia Square, are the windowless studio building, the office building, the 1,050-seat radio auditorium (at the rear of the interior traffic circle) and the business building group. William Lescaze is the architect.*



*BUILDING FOR TECHNICAL EDUCATION in Massachusetts. Top view shows construction of M.I.T.'s $1,400,000 School of Architecture building, in Cambridge, to be finished in September. Lower view shows the first unit of Northeastern University, Boston, providing quarters for offices, classrooms, engineering laboratories and shops.*

*PREPARING to prestress a 2⅝-in. cable for a suspension bridge over the Rio Magdalena in tropical Colombia. It was snowy April in Williamsport, Pa., when this cable and seven like it were made ready for shipment to the South American republic, where they will support a 512-ft. span.*



Bethlehem Steel Co. Ph

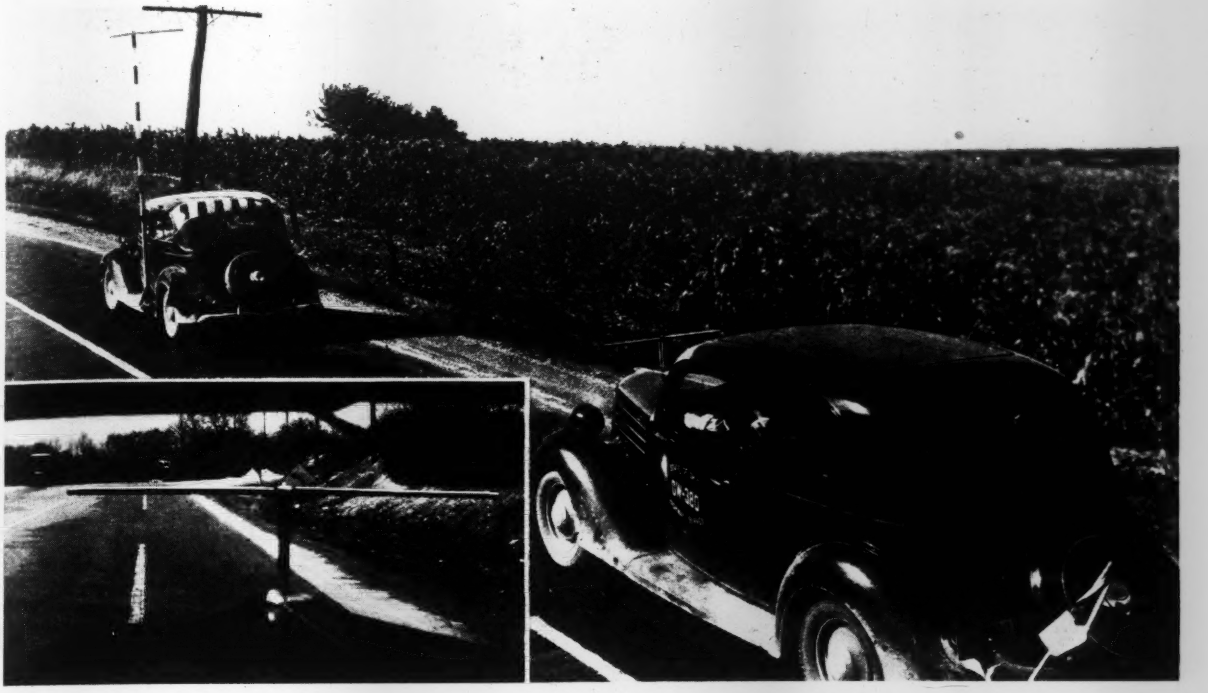


FIG. 1. CRITICAL SIGHT DISTANCES ARE MEASURED AT EVERY HORIZONTAL AND VERTICAL CURVE

# Metering Our Roads

*Countrywide surveys of all rural roads and investigations of highway traffic use under state and federal auspices are giving a basis for planning road programs*

LOSING A BASS DRUM is less difficult than what one of the 48 states recently managed to do, when it "lost" 6,000 mi. of road overnight. Back in 1921 this state reported to the U. S. Bureau of Public Roads, as a basis for the allocation of federal-aid money, that it had 40,200 mi. of road; the figure stood on the record unchallenged until last summer, when upon completion of an inventory of all the roads in the state, based on actual traverse of every road, it was found that the total mileage measured only 34,210.

While the mystery of what became of the lost 6,000 mi. has not been formally explained, the probable truth is that the earlier figure was a pretty rough guess, complicated by farm roads and mountain trails. Mention of the incident is not an idle thought. Much of what needs to be known about roads for intelligent planning of modern improvement is similarly indefinite.

The odd discovery of the missing mileage was an incidental byproduct of a countrywide study of roads and road service planned to provide definite facts. It began two years ago and is now moving rapidly along toward completion. This study represents the most important event in our road history since the construction of the National Road across the Alleghanies in the early days of the republic, and promises to have even greater effect on transportation improvement. It covers not only the roads themselves—their location, dimensions, conditions, financial and improvement record—but also the full facts of who travels over the roads and where, how much freight is moved and how far, what local conditions constitute traffic obstructions and whether the city dweller pays for country roads and vice versa. It is to include special studies of key points and analysis of safety conditions. The purpose of the investigation is to provide the essential service data from which an economical and efficient road program may be worked out. No similar study has ever before been attempted.

State authorities are doing the work, in cooperation with the Bureau of Public Roads and in accordance with a general plan of procedure laid down by the bureau. The necessary money is provided by allocation of 1½ per cent of federal moneys beginning with the 1935 fund, and the states are matching the federal contribution generally dollar for dollar. Two main divisions of the work—the road inventory and the traffic survey—are nearing completion; the others are in active progress all over the country or are just beginning.

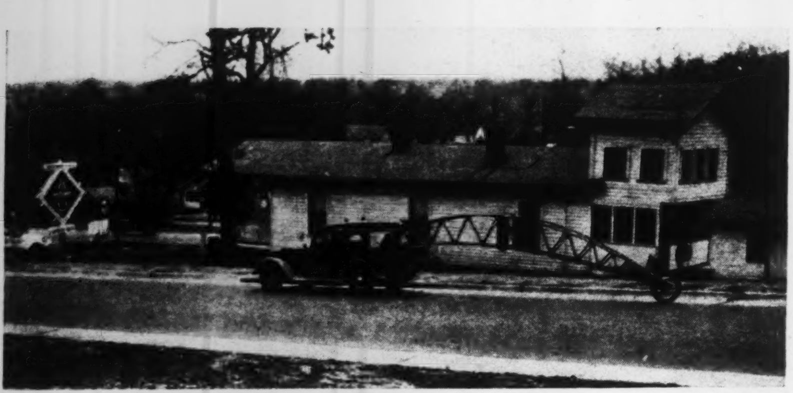


**Fig. 2.** A wheel trailed on a long arm attached to the rear of a car measures road curvature in terms of deflection angle, indicated by a pointer on a dial scale under the pivot of the arm.

To appreciate the conditions that caused the road-planning surveys to be undertaken, one must look back at how the road system of the United States evolved.

### Why the surveys?

Prior to about 20 years ago, roads had been opened up partly for through traffic within states and between states, and partly to give access to individual tracts of land. The latter purpose accounts for most of the roads in the region west of the Alleghanies, where the section and township system was applied, where the land was homesteaded and where the topography made it convenient to run a road along every section line—sometimes along half and quarter section lines. Many states in consequence have an average of 2 mi. of road per square mile of area. Surfacing and widening were carried out by townships, by county road departments and by the state, in rather haphazard response to public clamor for improvement to accommodate horse-drawn traffic.

A basic change of policy followed the initiation of federal aid in 1916. Soon after that date it proved necessary to adopt systematic procedure instead of continuing the haphazard selection of short stretches of road to be improved. Accordingly, in 1920 the so-called federal-aid systems were marked out on the road networks of the different states, under the law not to exceed initially 7 per cent in mileage of the entire length of road in the state. These federal-aid networks were laid out to include the principal through routes and the main roads between population centers. Little change has been made in the federal-aid networks since they were first marked out.

During the last two decades traffic has multiplied many times and has undergone profound changes in distribution, character and distance traveled. Increase of volume of traffic between two points has tended to build up traffic on numerous parallel routes in a great many cases; the growth of traffic in the main directions has also built up substantial volumes of cross traffic, tending to develop main-line or through traffic on roads that previously were land-access roads.

In the course of these developments, also, marked differentiation of road types according to traffic volume has evolved, so that the width, alignment, pavement or surfacing, etc., appropriate to a particular road depends very directly on the particular transportation function performed by that road.

Under these circumstances the random method of deciding on road improvements and their relative priorities can no longer be applied, since it became wasteful and inefficient. Not only the economy of road improvement but also the efficiency of transport and the safety of the traveler are at stake. Modern conditions, in short, call for far more precise planning and programming of the road networks than has been practiced in the past. This newer road planning must be based on data not heretofore available. Hence the inception of the road-planning surveys, which had their origin in the foresight of the officials and engineers of the Bureau of Public Roads.

Three major elements are included in these surveys: (1) Road location and condition surveys; (2) determination of traffic data, comprising volume, kind, weight, route and distances traveled, and principal users, and (3) financial and improvement statistics. Supplementing these three types of study, two others will be carried out, namely, a study of vehicle operation and performance and a study of safety conditions.

### Road inventory and mapping

The first essential of the entire work is a series of complete and correct maps of the road system, with pertinent information on nature and population of the territory traversed and on existing surface, curvature, superelevation and sight distance. To supply the data, every road in the state is traversed by a car of the

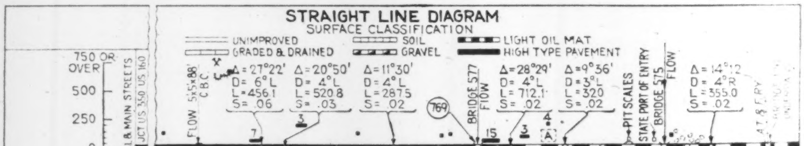

STRAIGHT LINE DIAGRAM
SURFACE CLASSIFICATION
UNIMPROVED
GRADED & DRAINED
SOIL
GRAVEL
LIGHT OIL MAT
HIGH TYPE PAVEMENT
750 OR OVER
500
250
0
250
500
750 OR OVER
LOG
STARKVILLE (UNINCORPORATED)
ENTER STARKVILLE
LEAVE STARKVILLE
BRIDGE 577
BRIDGE 575
PIT SCALES
STATE PORT OF ENTRY
FLOW
PROJECT NO & LENGTH
SURFACE TYPE
WIDTH TRAVELED WAY
WIDTH BTW SHOULDERS
WIDTH BTW FENCES
DRAINAGE
EXCESSIVE CURVATURE
RESTRICTED V SIGHT
RESTRICTED H SIGHT
SAFE DRIVING SPEED
LEGAL SPEED LIMIT
CURBS
SIDEWALKS
SUBGRADE FAILURE
EXCESSIVE GRADES
CAUSE OF RESTRICTION
FAP 2-9 1.35 MILES
CONCRETE PAVEMENT
CRUSHED ROCK
18'
30'
NONE
30'R&L
VSD=550
HSD=550
HSD=590
40
35
50
OVER CBC
TREES

**Fig. 3a.** One basic element of the road mapping program is a straight-line record sheet for each road based on an automobile traverse of the road.

state highway department and its location is laid down on the best available map, with proper record of all stream crossings, intersections, etc. Maps prepared from aerial surveys are used wherever they are available to check the road locations and culture as plotted.

On the main roads, curvature is measured and all points in nonmountainous areas where the sight distance is less than 1,000 ft. are located. In mountain country sight distances are measured if they are less than 650 ft. The equipment for checking up sight distance is shown in the views Fig. 1. It comprises two cars, the leading one carrying a stadia or flag rod while the rear one carries the observers; keeping the cross-bar on the radiator of the observer car just covering the space between roof and flag of the leading car, an interval equal to the so-called critical distance (1,000 or 650 ft.) is maintained; when the leading car disappears from view, showing that the sight distance is less than the required minimum, the cars are stopped and the shortest sight distance is determined by measurement.

To get a record of curvature, various devices are used; one is a trailing wheel with a long arm attached to the rear of a car as shown by Fig. 2. Where the arm is pivoted to the car it bears a pointer which by its position on a dial under the arm indicates the deflection angle and by direct proportion the curvature, the latter being entered on a log record by an observer as the car moves forward over the road.

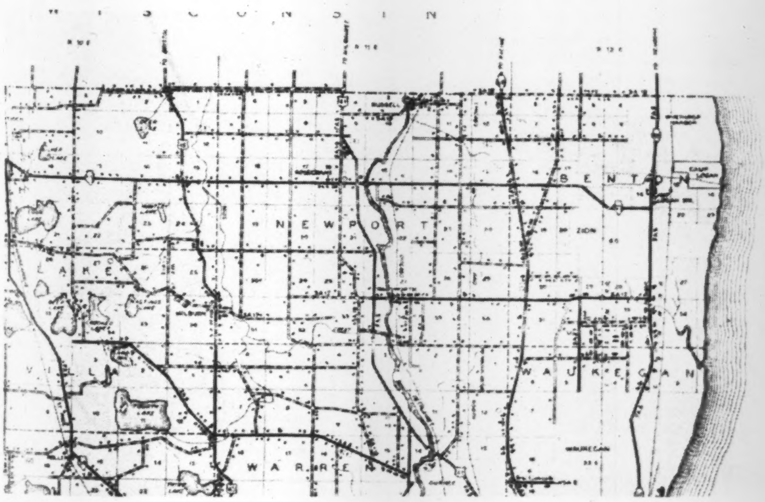


Fig. 3b. **Another basic element is a complete county map of all public roads, including information on road types and roadside culture.**

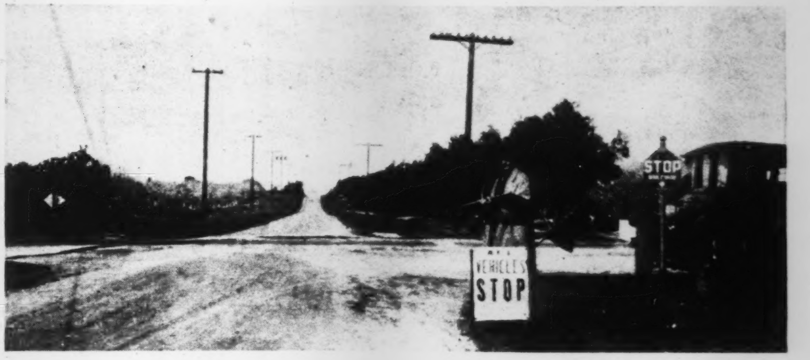


Fig. 4. **The human eye as a traffic counter: Posted at an intersection the observers make a count of the different classes of traffic. At some stations all vehicles are stopped and drivers are questioned about their origin and destination and other matters of planning interest.**

Several forms of maps are prepared as the result of these surveys. The straight-line or strip map (Fig. 3a shows part of such a map for a road near Trinidad, Colo.) contains in simplest record form all data on alignment, bridges and culverts, buildings and other objects nearby, towns passed through, road surface and date of construction (the latter data obtained from the office records of the state highway department).

Five series of county maps of the entire road network, generally excluding private roads and trails, are prepared on separate sheets, with indication of road type, roadside buildings, kind of use, etc. The county maps in turn serve as the base for three state road maps showing all primary and important connecting roads, forms of transportation, etc.

By the beginning of the current year these surveys, the main part of the road inventory, had been completed in more than three-fourths the area of the United States, and county base maps had been completed for nearly one-third of total area. Only nine states had not made a beginning on the work.

### Metering traffic

The most essential requirement for road planning is a body of accurate traffic data. It is necessary to know how much traffic every road carries and whether the traffic is mainly through or local. Percentages of out-of-state travel, truck traffic, general traffic patterns in a given region as defining the principal routes and directions, are important items of information, as are also the necessary facts to convert vehicle counts into vehicle-miles and freight ton-miles.

Obviously, few of these quantities can be determined with rigid accuracy. Some can be determined by continuous count, but in the main it is necessary to rely on sampling methods, on well-selected average values, and on special checks. The principal methods used are traffic counts, direct questioning by interview or by distribution of questionnaire cards to get origin and destination and trip length data, and by the weighing and measuring of freight vehicles. Various kinds of special-purpose studies are made, such as determination of choice between parallel routes, estimation of value of time saving, recording of traffic flow at branches and intersections, determination of principal classes of population and types of business that use the roads, etc.

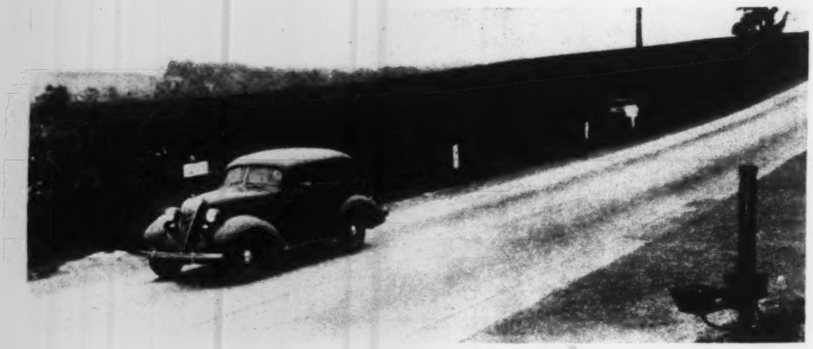


**Fig. 5.** The electric eye as traffic counter: Hundreds of these observing instruments have been set up on main roads, a few on local roads, throughout the country to make a complete record of number of vehicles passing. When both light beams are simultaneously interrupted the recorder counts one. Interruption of a single beam by a passing wayfarer does not cause a record.

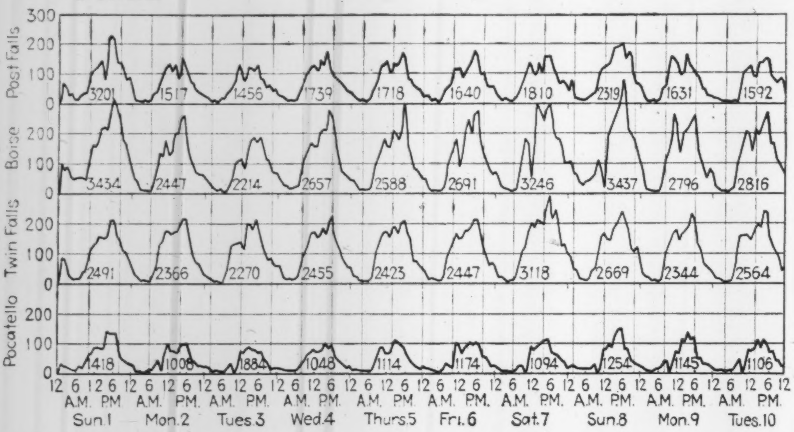


**Fig. 6.** Traffic time charts such as those here shown for four Idaho automatic counters are plotted from recorder counts. From top to bottom the four curves are for Post Falls, Boise, Twin Falls and Pocatello. Note the regularity of the pattern within each diagram for the same days of different weeks, and the dissimilarity of the several patterns in respect to days of the week and hours of the day.

Traffic counts by human observers, as at the station shown in Fig. 4, are one of the primary sources of data. The point shown is at the intersection of a main and a secondary road, and the observers count vehicles on both roads. Vehicles on the secondary road are questioned as to origin and destination (this generally is not practicable for the main road traffic). Number of passengers and amount and kind of freight are also noted.

At some observing stations of this kind, the vehicles are not stopped for detailed answer but are merely handed questionnaire cards to be filled out and returned, covering the same range of data.

An essential supplement to these observer counts is provided by automatic traffic-counters, which are of the electric eye or photo-electric recorder type. Several hundred of these are now in service on main roads in different parts of the country. Fig. 5 shows a typical installation; two light sources are used, as otherwise any passing object, such as a pedestrian, would actuate the recorder, while with two beams placed a suitable distance apart only an object as long as an automobile will interrupt both simultaneously and give rise to a count. The recorder totals the count at hourly intervals and stamps the number on a tape.

Automatic counters provide data for drawing traffic graphs of the kind shown by Fig. 6. The four graphs are for four locations in southern Idaho. In comparing the separate curves it may be seen that at any one station the graph has the same shape for corresponding days of the week, and even for the same hours of the corresponding days, but differs materially in shape for different days of the week; and that both the weekly and the daily pattern are different for the four different points, each thus having its characteristic traffic distribution. With the aid of such graphs it is possible to apply counts taken at specific times to the calculation of total traffic, and also to establish relations between mean traffic and peak density.

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*Methods of analyzing the data collected in these surveys will be described in an article to be published in the June 9 issue.*

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## Foraminifera Literature Being Catalogued

Existing literature pertaining to *Foraminifera*, best known of all the index fossils, is being catalogued in a geological research project of the American Museum of National History, New York. A report of this project, recently published, explains that *Foraminifera* have been marine inhabitants throughout geologic times, that their shells have been buried and imbedded in the sediment formed in ancient seas and that it is these sediments, consolidated in rock, that comprise most of the surface of the earth and extend far below the earth's surface in complicated series. To the *Foraminifera* student, surface geological conditions and their relation to this complicated series can be used to give a picture of what may be encountered in subsoil exploration and work. In the petroleum industry these tiny fossils have been used since 1917 in the solution of problems dealing with the accumulation of oil and natural gas, and have been used to advantage in connection with such engineering projects in about New York City as the water supply system, bridge pier foundations, midtown tunnel, and certain harbor developments. The report states that literature on this subject is extensive, but that prior to this cataloging it has been in such a jumbled state that it was difficult for scientists to make the fullest use of it.

Salaries of the workers on this project are being paid by the Works Progress Administration.

# Flow of Water Through Pipe Bends

*New data on velocity and pressure changes in 6-in. pipe bends useful in bettering hydraulic design*

Designers of hydraulic structures seeking to increase the efficiencies of plant operation will be interested in Technical Bulletin No. 577, U. S. Department of Agriculture, which presents the results of a series of experiments on the flow of water through bends in 6-in. circular pipe. New data on velocity and pressure changes in bends and in the tangents adjacent have been developed by these studies, according to David L. Yarnell, senior drainage engineer, Bureau of Agricultural Engineering, who conducted the research. The investigation was carried on at the hydraulic laboratory of the University of Iowa.

### Outline of studies

A bend acts as an obstruction to flow, causing loss of head, both in open and in closed conduits. Certain types of bends cause internal changes in velocity to such a degree that the capacity of the bends as hydraulic conduits is reduced considerably. As a rule, disturbed flow means inefficient flow, and the maximum usefulness of the entire cross-section of the channel is not realized.

The investigation, therefore, was planned to cover measurement of (1) velocity distribution in the bend and in approach and discharge tangents; (2) pressure changes at various sections in the bend and the tangents; (3) energy changes as the water passes around the bend; (4) loss of head due to the bend; (5) directions of the filaments of flow as the water moves around the bend; and (6) friction losses occurring in the approach and discharge tangents.

The experiments were conducted on bends of 6-in. pipe, the bends and the approach and discharge tangents being of transparent celluloid.

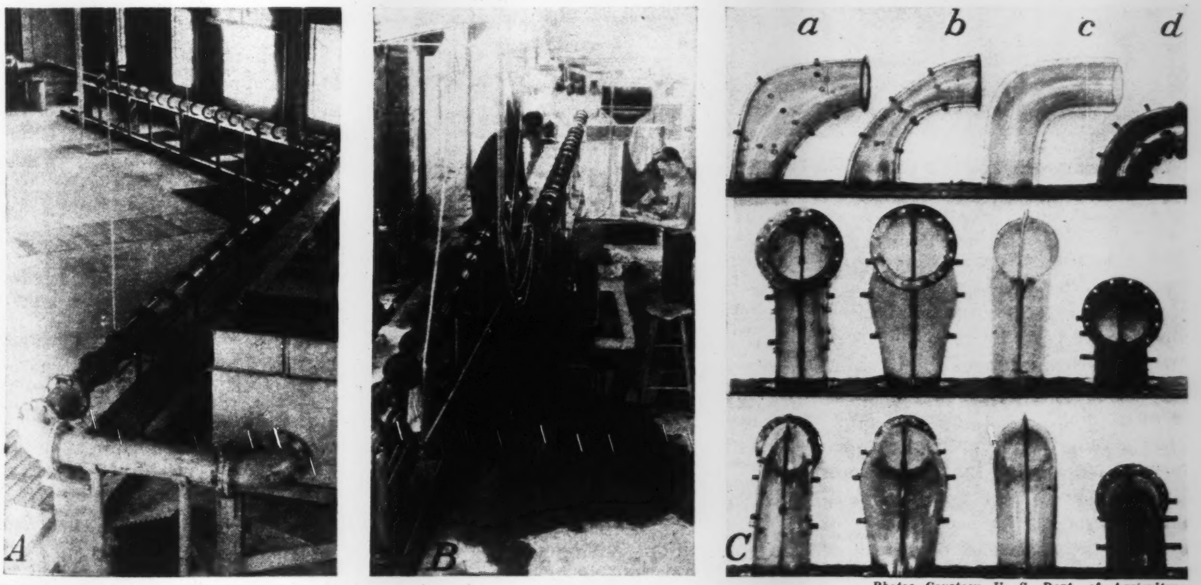
The results of the experiments led to the following conclusions:

(1) All bends act as obstructions to flow, causing greater loss of head than an equal length of the straight pipe.

(2) The velocities of the filaments along the inner side of the bend are increased and those along the outer side are decreased in their velocity in the tangent approaching the bend.

(3) The loss of head increases with increase in length of the bend, for pipe of equal size, equal radius of curvature, and like material and conditions, and is greatest for a bend in which the tangents are joined without an intervening curved section. The ratios of the loss in head caused by the other round-pipe bends to that caused by the 90 deg. standard bend were approximately, for the 45 deg. bend, 0.75; for the 180 deg. continuous curvature bend, 1.5; for the 180 deg. reverse curvature bend, 2.1; for the 270 deg. bend, 2.7; for the miter bend, 7.8.

(4) For a given pipe bend and given quantity of flow, the head lost in the bend is influenced greatly by the velocity distribution in the approach tangent. With velocity in the approach tangent high toward the inner side, the losses of head shown by all the bends range from about 1.5 to four times that obtained when uniform velocities prevail in the approach tangents. With the approach velocity high toward the outer side, some bends showed slightly less and some slightly greater losses than obtain with uniform velocity of approach. With high velocity at the top of the approach tangent the loss for each bend was between 1.25 and two times that obtained with uniform approach velocity, and with



Photos Courtesy U. S. Dept. of Agriculture.

Fig. 1. **Laboratory setup for tests on: (A) 45-deg. bend and tangents; (B) 180-deg. reverse curvature bend and tangents. Special-shape and standard bends are shown in C.**

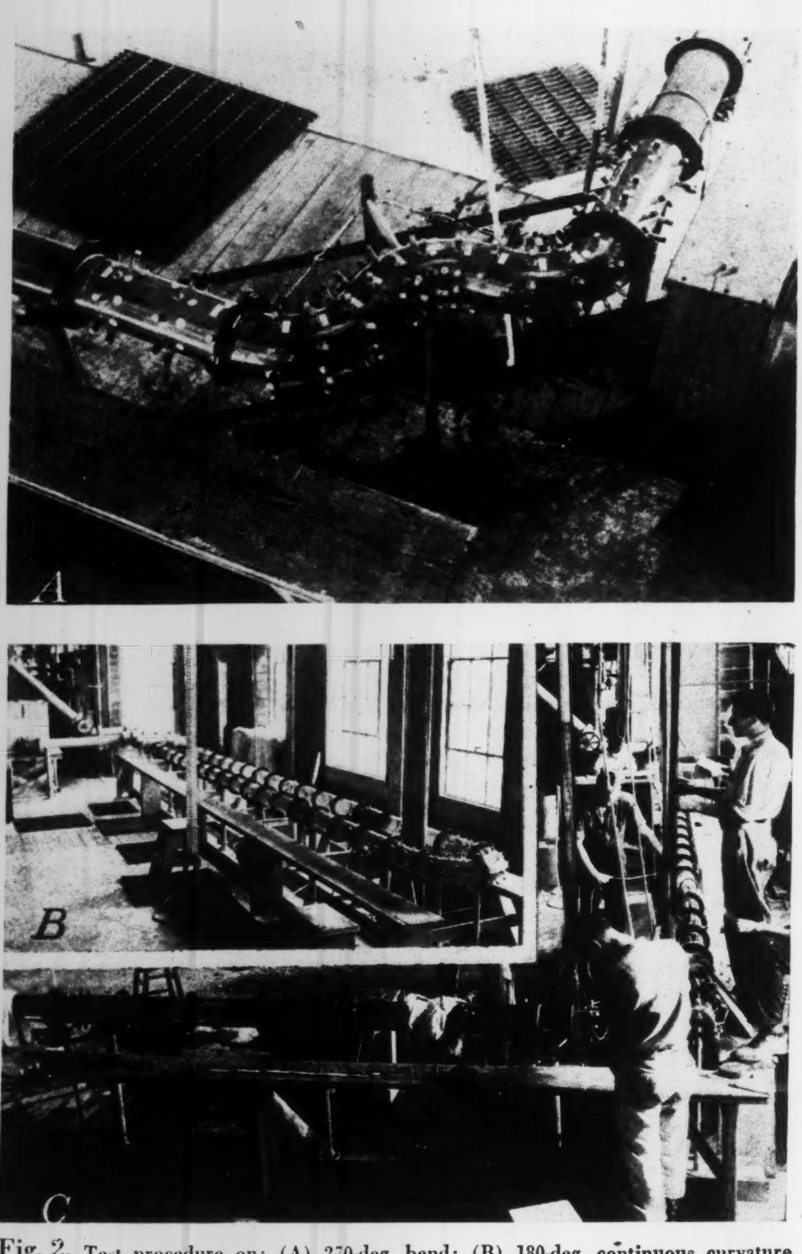


Fig. 2. Test procedure on: (A) 270-deg. bend; (B) 180-deg. continuous curvature bend and tangents; and (C) meter bend and tangents.

approach velocity high at the bottom the loss is between 1.3 and three times that obtained with uniform velocity. These ratios were obtained with a high velocity along one side of the approach tangent and about three times the low velocity along the other side.

(5) From the difference between the pressures on the inner and outer sides of a bend at the point of maximum differences, having the size of pipe and the radius of curvature of the bend, it is possible to compute the mean velocity and therefore the quantity of flow. When a pipe bend has been calibrated it may be used as a flowmeter with which discharge can be determined by measuring merely the difference in pressure.

(6) The losses in the pipe bends experimented upon appear to vary as the square of the velocity, and not as the 2.25 power suggested by some investigators.

### Some practical applications

Observations during the test show **that** a single piezometer on a bend or close to the bend on a tangent may not give the correct average pressure in the conduit at the cross section. Hence it is highly important, said the report, that in such work as making efficiency tests on pumps, the piezometer determinations be made at several points on any section.

The experiments showed considerably greater loss of head in bends of reverse curvature than in bends of continuous curvature. This points to the advantage in water piping installations to avoid, so far as practicable, reversal of direction of curvature by bends placed near together.

In many installations a pipe bend could be used as a flowmeter by measuring the difference in pressure between the outer and inner sides. That difference may be as large as or even larger than that produced in a Venturi meter or pitot tube and, as in those other measuring devices, it varies with the second power of the velocity. The experiments indicate, said the report, that the errors likely to be involved in using the bend for this purpose are no greater than those experienced with the other devices named.

From the information obtained on loss of head resulting from nonuniform velocity distribution in the approach tangent, it is apparent that in planning pipe layouts if two bends on the same line curve in the same direction, the second will cause less loss of head than the first if the bends can be placed near together.

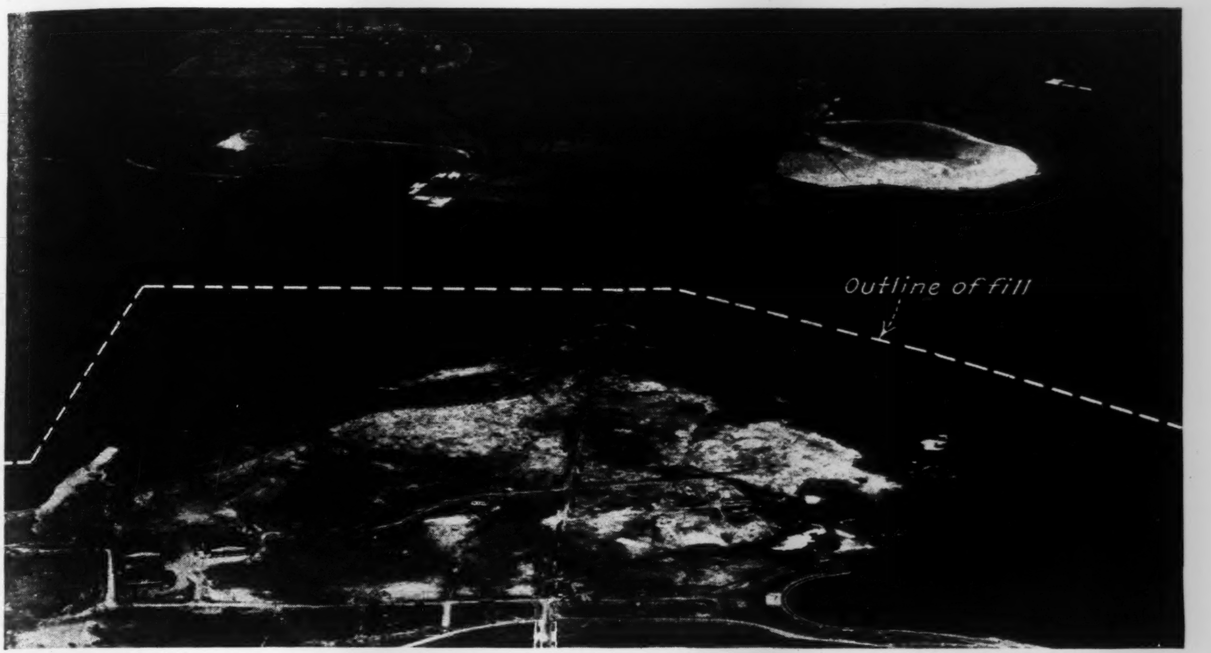
Copies of Technical Bulletin No. 577 which is a publication of the U. S. Department of Agriculture, made in cooperation with the University of Iowa College of Engineering, may be obtained from the Superintendent of Documents, Washington, D. C., at 15 cents each.

• • •

## Open Web Framing Permitted in Pennsylvania

USE of open web joists and studs erected by field welding has been approved by the Pennsylvania PWA Authority in construction of the framework of a new dormitory at the State Teachers College at East Stroudsburg.

Cost estimates indicated that the use of load-bearing open-web studs was more economical than employment of load-bearing masonry would have been.



Aerial Explorations Photo

FIG. I. REFUSE HAULED BY TRUCK FROM RIKERS ISLAND (TOP) IS USED AS FILL MATERIAL FOR NORTH BEACH AIRPORT.

# Ash Fill on Muck Base Makes Airport

*Land reclaimed by dumping old rubbish from Rikers Island over deep silt formation provides site for Nation's largest air field at North Beach, New York City*

A MOST UNUSUAL and difficult grading operation is involved in the construction of the new North Beach Airport on Long Island within the limits of New York City, which the sponsors plan to make the largest and best equipped commercial field in the country for both seaplanes and land aircraft. The site is a point projecting into East River between Bowery Bay and Flushing Bay, opposite New York's odoriferous rubbish dump on Riker's Island. The nucleus of the new field is a former airport of 105 acres to which is being added 200 acres by reclaiming the riverfront and 130 acres by leveling off an area landward from the old field, thereby creating a level tract of 435 acres.

To build out the riverfront, some 12,000,000 cu.yd. of old rubbish is being hauled by truck from Riker's Island over a temporary trestle and dumped into shallow water on top of 70 ft. of soft muck. An additional 3,500,000 cu.yd. of fill is available from land grading operations. The job is being worked three shifts a day, six days a week, and a battery of 160 trucks loaded by eleven shovels is moving 46,000 cu.yd. a day or more than a million cu.yd. per month. The construction schedule contemplates completion of the grounds and installation of some of the services by next April, in time for the opening of the New York World's Fair. Work started at the site Sept. 9, 1937.

The airport is a WPA project, with the New York City Department of Docks as sponsor. In magnitude it is one of the outstanding construction operations in the country, the cost being $25,000,000. As the WPA in New York is under the direction of an army engineer, the project is being handled in the same manner as Corps of Engineers day-labor operations. It is fully mechanized; the WPA bought 100 new 8-yd. trucks and 60 more of similar capacity are being rented along with power shovels, graders, bulldozers, and cranes.

### New York's first real airport

North Beach will provide the city with its first satisfactory and adequate airport. At present commercial transport lines use the Newark field, 14 miles from the city, as their New York terminal, while seaplanes use inadequate quarters on Manhasset Bay, beyond the city limits to the east on Long Island Sound. The new field can be reached from Times Square in 30 minutes. The new Grand Central Parkway, connecting with the Triborough Bridge, passes the site.

Design of the field and its services were made with the advice of the major air transport companies. Both present needs and future trends were considered.

The field will provide four main paved runways from 3,650 ft. to 4,770 ft. long, one of them 200 ft. wide, the others 150 ft. wide, laid out in north-south, east-west, and the two diagonal directions. Three channels, each 600 ft. wide and 15 ft., from 3.5 to 4.0 miles long, with a turning base at their ends, will serve the seaplanes. As shown in Fig. 3 the ultimate plan calls for seven hangars and an administration building for land planes, and two hangars and an administration building for seaplanes. The land services are arranged in a long sweeping arc bordering on a small boat basin owned by the city Department of Parks. Each land hangar will be 164x350 ft., with a 40-ft. extension along one side for shops and offices. The two seaplane hangars are star-shaped, so arranged that their present 200-ft. door clearances can be widened by extending the main trusses. The first stage of development includes all runways and both administration buildings, but only two of the hangars. All structures will be on pile foundations.

The field will have lighted runways and radio flying beams.

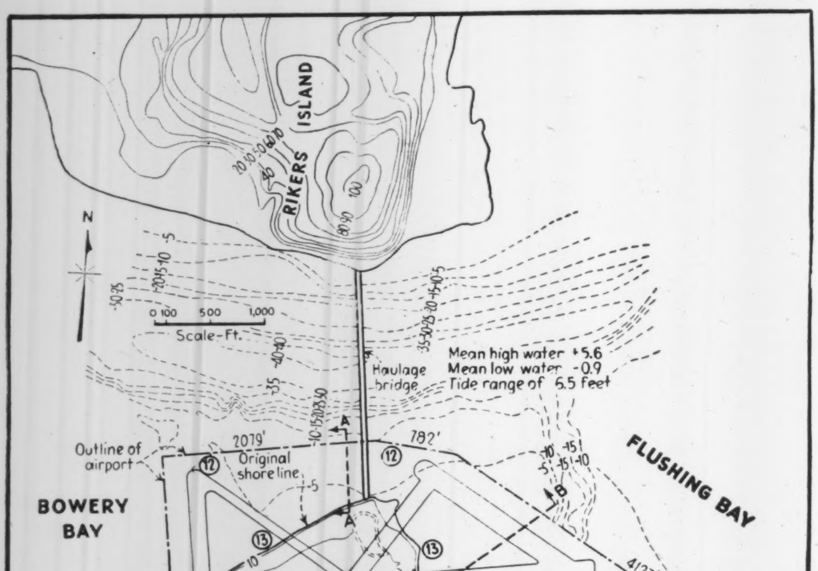

RIKERS ISLAND
N
0 100 500 1,000
Scale-Ft.
Haulage bridge
Mean high water +5.6
Mean low water -0.9
Tide range of 6.5 feet
Outline of airport
2079'
782'
Original shore line
A
B
FLUSHING BAY
BOWERY BAY
2166'
4127'
New bulkhead
1560'
Boat Basin
PARKWAY
19th St. bridge
GRAND CENTRAL
1187'
⑬ = Elev. finished airport
Shore line
Fill
750'
Grade
MLW
2.6
25.7'
72.5
Silt
20'
95.1
Sand
Section A-A
1250'
12'
53.5
67.8
78.8
Section B-B

Fig. 2. Grading and filling operations at North Beach involve some fifteen million yards of excavation. This map shows the original conditions and contours at the site, also the outline of the completed fill.

### Foundation and fill problems

For the second time in two years the availability of a huge deposit of ashes and rubbish made possible large scale filling operations in New York. Conditions at North Beach were somewhat similar to those at the Flushing Meadows where 6,000,000 cu.yd. of rubbish were spread over deep muck to form the site of the coming World's Fair (*ENR*, Oct. 22, 1936, p. 565). However, at the fair site the muck was topped by a heavy mat of vegetation that provided some bearing value, while at North Beach the muck area is all under water.

Naturally, the placing of fill over deep soft muck gave the authorities much concern. Undisturbed samples of the silt were obtained by numerous borings made by the U. S. District Engineer Office and samples of the Riker's Island fill were obtained from test pits. Both materials were analyzed at the Ithaca testing laboratory of the Binghamton Engineer District, and analytical reports were prepared by the army engineers and by an outside consulting engineer.

### Soft, silty clay

The reports reveal that the subaqueous material is a very soft, silty clay with an average depth of 70 ft., resting on a sand of unknown depth. The silt has a water content of about 50 per cent, a percentage of voids of some 75 per cent, and is not fully consolidated under its own weight, particularly in the top 20 ft. Submerged, the silt weighs 30 lb. per cu.ft., in air it weighs about 92 lb., and has a specific gravity of 2.7. Tests show it has a shearing strength of only 60 lb. per sq.ft. The Riker's Island material is a combination of ashes and rubbish, full of iron and other scrap material, but with most of the organic material either rotted or burned out. It weighs about 70 lb. per cu.ft., and contains from 5 to 10 per cent of material lighter than water which will probably float away when deposited in the river.

The problem was to provide a stable fill over the muck within cer-

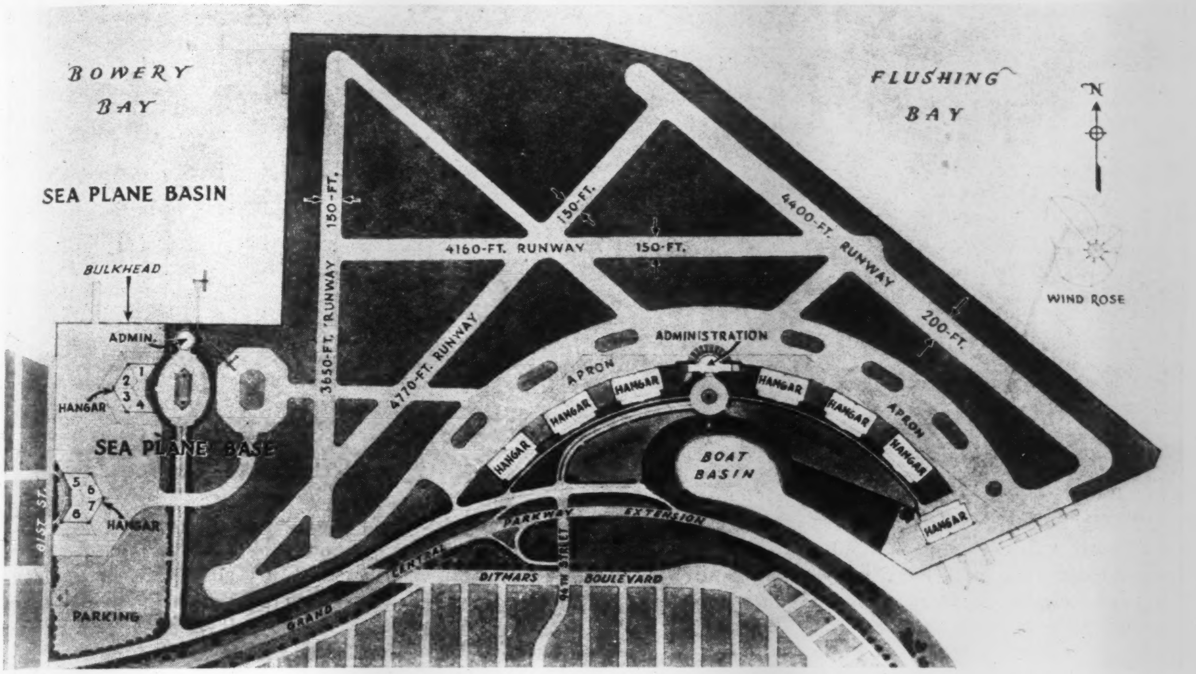


Fig. 3. **Long, wide runways and ample buildings and other services will make the new North Beach Airport one of the finest in the country for both land and sea craft.**

tain economic limits and without creating mudwaves, whose removal from nearby navigation channels would endanger the fill. Studies indicated that even with the use of the light fill from Riker's Island excessive settlement and disastrous mud waves would result unless extreme care was used in the filling operations. Yard level, therefore, was established about 12 ft. above mean low water, requiring a maximum depth of fill of about 20 ft., exclusive of settlement of fill material into the silt. The theoretical amount of fill required, between river bed and grade, is about 6,000,000 cu. yd. However, because of settlement into the mud, the estimated requirements are double this.

Calculations showed that, despite the low shear value of the foundation, the fill could be made by deposition and spreading in shallow layers kept at a slope at least as flat as 35:1. The estimated amount of settlement, varying with the silt depth, is as high as 8 ft. in some places. However, it is expected most of the settlement will take place during filling operations under the packing of trucks and bulldozers. A minimum depth of fill of 8 ft. is considered necessary to take care of the landing loads, and the outer toe of finished slope must be left as flat as 20:1 to properly retain this fill.

Other plans for filling were considered, but were all rejected as impracticable or too costly. These included hydraulic filling; the building of a fill of firm material around the perimeter, then dewatering the interior area and depositing fill in the dry; a similar plan with a bulkhead or cofferdam; and filling first under the runways to get maximum settlement at these locations in the early stages. The final plans contemplate a bulkhead only along the south end of the seaplane mooring basin where close access to the shore is desired; all other shorelines will be sloped. This bulkhead, 1,560 ft. long, will be of steel sheetpiling.

Some movement of the mud is inevitable. Along the main or north front, a mudwave is not serious, for the navigation channel is far from the finished shoreline. However, to the west a seaplane basin will have to be dredged to a depth of at least 15 ft., and as such dredging operations close to the new fill would endanger the stability of the shoreline, attempts are being made to displace all of the muck possible along the west shore by building out on steep slopes with the heavier materials obtained from land excavation.

Transportation of the Riker's Island fill to the mainland was another problem. Studies showed that trucking was the most desirable means of haulage, although this required a long bridge crossing a navigable channel that is used by small boats only, principally tugs with barge tows. First plans for the bridge, 2,200 ft. long, contemplated a conventional wooden trestle rising to a height of 25 ft. over the channel, where a 245-ft. through truss was to provide navigation clearance.

However, further studies showed that a low trestle of steel H-beam piles and steel stringers, carrying a wooden deck, and a 245-ft. floating channel span instead of a fixed or movable truss, would be more feasible, especially as time required to obtain the wood piles would have delayed start of filling operations. Details of this interesting bridge are given on page 783.

### Placing the fill

Excavation and loading of the rubbish is by ten 2½-yd. shovels, serving about 150 trucks. The Riker's Island dump, which rises to points 100 ft. above river level, is being worked in 15-ft. cuts carried fairly level. There is some 14,000,000 cu.yd. of material available at the dump, but unless the settlement of the fill is more than is now expected,

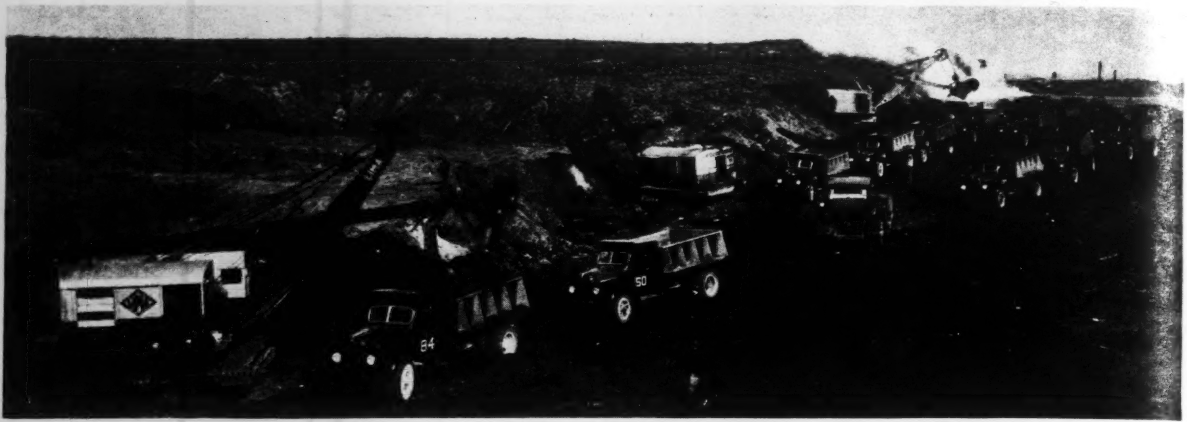


Fig. 4. **Every twelve seconds one of 160 trucks rolls away from the Rikers Island dump with 8 yd. of material for the new fill. Parts of the dump are hot from long-smoldering fires.**

only 12,000,000 yd. will be required. Accordingly, the dump is being worked to leave a level tract whenever operations cease. Deep cuts and contour roads were made for main access to several strategic points on the dump. While the refuse material packs well under traffic and drains quickly after rains, the main access roads are sanded to reduce rutting under the concentrated loads they carry. The bench floors are stable enough to carry the trucks, though occasional grading is required to reduce rutting.

Smooth working excavation and haulage schedules result in an 8-yd. load of rubbish every 12 seconds, requiring a steady stream of trucks across the bridge in both directions. The average haul is one mile. Though the bridge heads are bottlenecks in the haulage system, traffic is kept moving under the direction of flagmen. Trucks are assigned to specific shovels and fill areas, and an attempt is made to keep the shovels working every moment, even if this results in an occasional piling up of empty trucks.

The sequence of filling is to start an area at low tide, then build it up as the water rises. Trucks are, in general, dumped along the inner edge of a fill area, and the material is spread by bulldozers which maintain the flat slope of fill desired. The fill is carried practically at grade as operations progress riverward. By the time a section has been filled in to grade, it has been sufficiently packed by trucks and tractors to become stable.

Excavation of the land areas is by two shovels serving twenty trucks. This heavy fill material is deposited only on low dry land sections or in that part of the fill adjoining the seaplane basin, where displacement of the underlying muck is desired. Bulldozers spread this material to place.

For night work the loading areas are illuminated by lights on the shovels and trucks and by individual carbide floodlights. At the fill the carbide lights are supplemented with electric floodlights on wooden towers. Some of the towers are portable so they may be moved as filling progresses.

### Job organization

The field organization is divided into five sections: administration, planning, construction, supply and safety, the last including medical and hospital service. Five per cent of the total personnel may be noncertified and 5 per cent may be unrestricted as to security wages; the remainder is from certified relief rolls restricted to security earnings. The year has been divided into thirteen four-week work periods, and the security wage workers, while paid the prevailing hourly rates, are restricted to maximum earnings in any one period. As these security amounts vary from $56.50 for unskilled labor to $95 for certain skilled trades, almost every class of worker has a different time schedule for each period. It is the duty of the personnel subsection to keep track of the time worked by each individual, to assign the workers to definite shifts and to keep the working units at a certain strength, a most bewildering bookkeeping job.

The job is worked three 8-hr. shifts per day, six days a week, though the garage, hospital and guard units also work on Sundays. At present there are 3,500 persons on the payroll, although the number at work at any one time is only a fraction of this figure. For example, each shift of steelworkers on the buildings requires 35 men, or 105 for a 24-hr. day. Yet 380 men of this classification have to be kept on the certified list to maintain the shift crews. Likewise, to man 106 trucks requires 580 chauffeurs.

The WPA bought 100 new trucks, all other equipment, including 60 trucks, twelve shovels, eighteen bulldozers and two cranes, is rented, rent including operators and fuel. An abandoned hangar serves as the garage and repair shop for the WPA trucks. Each of these trucks has a definite schedule of reporting to the shop for gas, oil, tire service and inspection.

All supplies and materials are secured through the Procurement Division of the federal government, necessitating long-range planning and anticipation on the part of the field organization.

As part of the city's contribution to the project, the Department of Docks contracts for all foundation piling required for the buildings, building of the bulkhead, and dredging of the seaplane basin. This department also furnishes the floating span of the bridge. The trestle was furnished and built by WPA.

The project is under the direction of Lt. Col. Brehon Somervell, WPA administrator for New York City, with Capt. R. Selee as director of operations. Gayle McFadden, assistant director of operations, is in

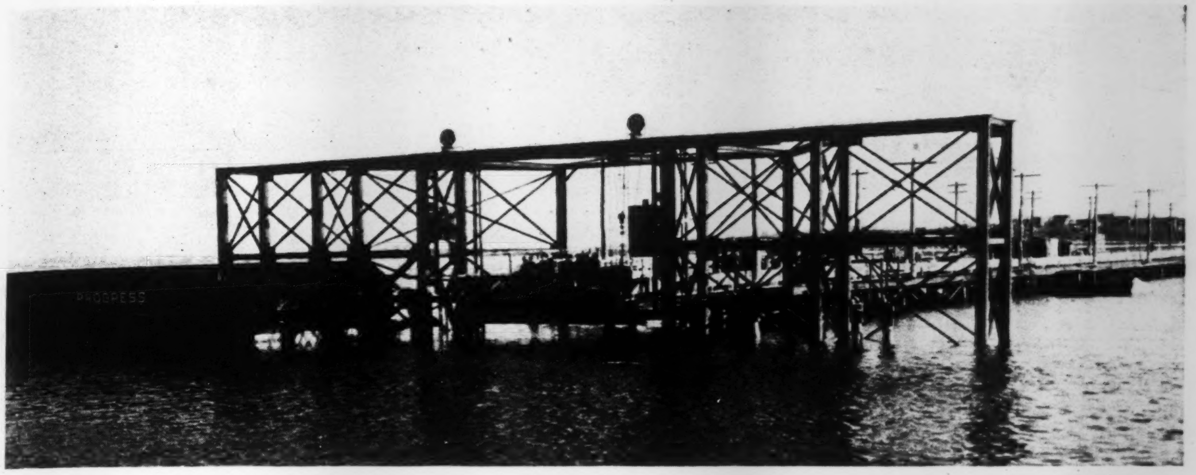


**Fig. 5. Drawspan of the temporary bridge to Riker's Island. A 245-ft. steel barge swings to one side when tugs and other small craft desire to use the channel between Riker's Island and North Beach.**

charge of the job, and John M. Townsend is coordinator of operations. Plans were prepared under the direction of Samuel E. Stott, chief of the design unit of WPA, and by Delano & Aldrich, architects. The city is represented by the Department of Docks, John McKenzie, commissioner, Frank O'Keefe, chief engineer, and Wm. T. Doran, assistant engineer. Analysis of foundation conditions were made by B. R. Hough, Jr., of the New York district engineer office, and Theodore Knappen, of the consulting firm of Parsons, Klapp, Brinckerhoff & Douglas. The Raymond Concrete Pile Co. held the first contract for piledriving.

## Temporary highway bridge

The novel temporary highway bridge with its floating swing span that was built to provide a truck haulageway between Riker's Island and the North Beach is 2,200 ft. long and carries a double roadway.

The fixed part of the trestle consists of five-pile bents of 14-in., 87-lb. H-section, spaced 40 ft. apart and capped with a steel cross beam. The floor system is six 24-in. steel stringers carrying a 3x8-in. laminated wood deck 24-ft. wide.

The channel span is an all-welded steel barge 245 ft. long, 29 ft. wide, and 10 ft. deep, with underslung continuous brackets extending out from each end. The barge is hinged at one corner through a bracket to a pipe pile driven outside an H-beam pile. When necessary to open the bridge—seldom more than two or three times a week—the barge is swung to one side by two electric winches pulling on cables anchored to piles. The span can be opened or closed in five minutes.

To compensate for an 8-ft. tide range there is a 40-ft. transfer span at each side of the channel, hinged at the shoreward end and supported at the channel end by a counterbalance and winch system carried on a framework of steel piles. The transfer span extends over the barge brackets when the bridge is in closed position, a bearing plate on the spans resting on rounded plates on the barge. The weight of the spans is sufficient to hold the barge in place without locking devices. When necessary to open the bridge the transfer spans are raised to clear the barge.

The bridge was designed and built by the WPA organization of New York City, in cooperation with the city department of docks. The J. K. Welding Co., New York, built the floating span.

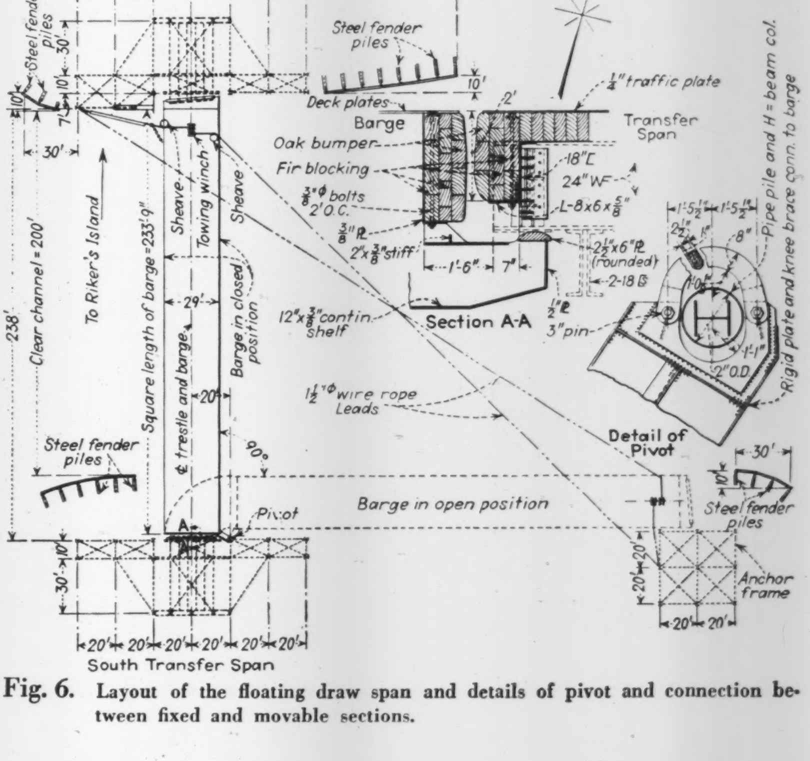

North Transfer Span
20'
20'
20'
20'
20'
20'
80'
Steel fender piles
30'
10'
10'
7'
30'
Steel fender piles
10'
N
Deck plates
Barge
2'
¼" traffic plate
Transfer Span
Oak bumper
Fir blocking
⅜"ϕ bolts 2' O.C.
⅜" Pl.
2"x⅜" stiff
18" [
24" WF
L-8x6x⅝"
2½"x6" Pl. (rounded)
2-18 [s
1'-6"
7"
½" Pl.
12"x⅜" contin. shelf
Section A-A
3" pin
1'-5½"
1'-5½"
2½"
1"
8"
1'-0½"
1'-1"
2" O.D.
Pipe pile and H = beam col.
Rigid plate and knee brace conn. to barge
Detail of Pivot
To Riker's Island
238'
Clear channel = 200'
Square length of barge = 233'-9"
Sheave
Towing winch
Sheave
29'
℄ trestle and barge
Barge in closed position
20'
1½"ϕ wire rope Leads
90°
Steel fender piles
Barge in open position
Pivot
A
30'
10'
Steel fender piles
20'
20'
Anchor frame
20'
20'
10'
30'
20'
20'
20'
20'
20'
20'
South Transfer Span

**Fig. 6. Layout of the floating draw span and details of pivot and connection between fixed and movable sections.**

# Notes on Sewage Disposal

## *A monthly summary of current developments conducted by Willem Rudolfs*

*AERATION PERIOD* — Generally the aeration time required for the activated sludge process amounts to 6 hours in this country and sometimes considerably longer abroad. The amount of air used under these conditions varies from 1 to 1.5 cu. ft. per gallon of sewage. When the sewage is weak smaller quantities of air have been applied, but the aeration time has usually been kept at 5 to 6 hours. What a combination of weak sewage and careful control can accomplish has been demonstrated at the North Side activated sludge plant in Chicago (*Budget Report*, Sanitary District, 1938). At this plant tests have led to the practice of using small amounts of air and short aeration periods in the treatment of a flow of 205 m.g.d. The sewage has an average 5-day B.O.D. of 107 p.p.m. and a suspended solids content of 140 p.p.m. The more important data regarding the operation show the production of an effluent low in B.O.D. and suspended solids:

| | *Battery B* | *Batteries A & C* |
|---|---|---|
| Aeration, Hours | 3.0 | 4.5 |
| Air, cu.ft./gal. | 0.35 | 0.35 |
| B.O.D. effluent, p.p.m. | 9.5 | 9.1 |
| Susp. Solids effluent, p.p.m. | 13.0 | 12.0 |

It is interesting to note that with the quantity of air remaining constant apparently no improvement is obtained when the aeration time is 50 per cent longer.

*USE FOR SULPHITE WASTE*—Studies on the embrittlement of boiler steel conducted during the last three years have produced considerable interest in sodium sulfate as a protective agent. Schroeder, Berk and O'Brien (*Trans.*, A.S.M.E., Jan. 1938) studied a number of chemicals and compounds and found that lignin sulphonate and concentrated sulphite waste liquors prevented cracking even when a very high stress was applied at elevated temperatures. Protection was not lessened in the presence of high sodium silicate or high sodium hydroxide concentrations. The sulphite liquor was found to be suitable at all temperatures up to 250 deg. C.

*SUPERNATANT LIQUOR*—Separation of water from sludge particles present in supernatant liquor is a problem encountered at many sewage treatment plants. Return of dense supernatant liquor to the raw sewage affects the settling of solids present in the raw sewage and places an additional load on any oxidation device following sedimentation. These difficulties are increased when the digesting sludge is vigorously stirred by mechanical means or through prolific gasification. The separation of water from digested sludge is a function of time, original concentration of sludge and quiescence. Hicks (*The Surveyor*, Mar. 11, 1938) reporting on the digestion of sewage sludge containing large quantities of grease and soaps describes difficulties encountered with obtaining clear liquor from the digestors. The sludge concentration throughout the tanks was uniformly dense even when two-stage digestion was practiced. To overcome the difficulties the so-called supernatant liquor was transferred to a shallow tank where excellent separation of clear liquid took place with a B.O.D. of 740 p.p.m. and only traces of suspended solids. This compares with a B.O.D. of 800 p.p.m. of the raw sewage. The good results are due apparently to settling the supernatant liquor under quiescent conditions for a period of 4 to 5 hours, and not to the shallowness of the tank used for this purpose.

*SLUDGE PRESSING*—In order to consistently produce a good sludge cake it is essential to note changes in the character of the sludge and to vary the treatment accordingly. This holds for sludge dewatering by vacuum filtration as well as by filter presses. During the last few years considerable advance has been made in the filter pressing control: the sludge is kept in fresher condition, pH values are carefully maintained and the fouling of cloths due to mechanical defects and septicity of sludge have been overcome. The present scheme of placing cheese cloth covers over the filter cloth (thus permitting more rapid and cleaner removal of the cake), together with other improvements brings pressing methods well within the cost range of other types of sludge dewatering. Thompson (*The Surveyor*, Feb. 4, 1938) describing the filter pressing at Leeds states that 131,900 tons of 90 per cent moisture content sludge filtered under pressure produced 36,780 tons of 60 per cent cake. The cost: $1.05 per ton of cake or 29¢ per ton of 90 per cent sludge. This includes all labor, chemicals, cloth, power, storing, fuel, etc., but not interest and sinking fund charges. To keep the sewage fresh chlorine is added.

*RECIRCULATION*—Recent developments in sewage filtration have varied from passing settled sewage through magnetite and sand to high rate trickling filters. A trickling filter effects a greater gross efficiency when high rates of sewage are applied, but produces a generally poorer effluent than that obtained when operating at a low rate. The extent of B.O.D. reduction apparently depends upon the number of times the sewage is recirculated, or conversely the extent to which recirculation is necessary for any desired effluent depending on the B.O.D. of the sewage. Eldridge (Mich. Eng. Exp. Sta. *Bull.* 77, 1937) studying recirculation of milk waste experimentally found that a trickling filter operated at the usual rate of 1 m.g.a.d. without recirculation produced B.O.D. reductions between 65 and 70 per cent; a 65 per cent reduction was possible, however, at a rate of 3.4 m.g.a.d. when the waste was circulated 6 times. At a rate of 2.4 m.g.a.d. and a circulation of 8 times better than 80 per cent B.O.D. reduction could be obtained. By means of recirculation a reduction in size of the filter can be effected and the B.O.D. removal can be adjusted to any desired degree. To equip standard trickling filters for recirculation greatly increased pump capacities and some method for returning effluent to a holding tank are required.

FIG 1. HEAD OF BUZZARDS BAY LOOKING ALONG THE NEW APPROACH CHANNEL TO THE CAPE COD CANAL

# An Ordered Tidal-Canal Flow

Donald F. Horton

Associate Engineer, U. S. Engineer Office, Boston, Mass.

*Flow in Cape Cod Canal improved by remodeling the ocean bottom at the west end to a plan suggested by model tests*

THE PHYSIOGRAPHY of the head of Buzzards Bay, Massachusetts, the western approach of the Cape Cod Canal, has recently undergone a marked change upon the completion of three dikes, the construction of which was recommended as a result of comprehensive hydraulic model studies which indicated that these dikes would materially improve flow conditions affecting navigation in Buzzards Bay and in the canal proper. The location and principal features of these dikes, one extending 2 mi. southwest from Stony Point to Abiels Ledge, the other two connecting the eastern shore with Hog Island and Hog Island with Mashnee Island, are shown in Figs. 1 and 2. The dikes were constructed of material dredged hydraulically from the new straight Hog Island approach channel and adjoining west mooring basin, all required parts of the improvement program now in progress under the direction of U.S. Army Engineers.

The approved project for the Cape Cod Canal, a ship canal slightly more than 13 mi. long (including the Buzzards Bay approach) which connects Cape Cod and Buzzards bays, calls for enlargement of the existing canal to provide a sea-level canal 540 ft. wide on the bottom and 32 ft. deep at mean low water. Other important accessory features of the improved canal, in addition to the dikes, west mooring basin and straight Hog Island approach channel mentioned above, are two high-level fixed highway bridges, one vertical-lift railway bridge, an east mooring basin and an improved lighting system. The estimated cost of the project, started in 1933 and now nearly 50 per cent completed, is about $32,000,000, including the cost of the new bridges completed in 1935.

### Model studies initiated

Since the tides of the two bays which the canal connects have different ranges and are several hours out of phase, a tidal flow of varying intensity occurs in the canal, the water flowing twice daily toward each bay. This constantly-changing rate of flow makes it practically impossible to determine analytically, in advance, water surface elevations, velocities and other hydraulic data for the enlarged canal cross-section, particularly in view of the fact that it is to be expected that the change in rate of flow resulting from change in size of canal cross-section will modify the tides at the ends of the canal, especially the Buzzards Bay end. Accordingly, to secure data concerning hydraulic conditions for the enlarged canal, model studies were undertaken at the River Hydraulic Laboratory of the department of civil and sanitary engineering of the Massachusetts Institute of Technology.

A concrete model of the enitre canal and approaches, including 1 sq. mi. of Cape Cod Bay and 11½ sq. mi. of Buzzards Bay, was built to a horizontal scale of 1 to 600 and vertical scale of 1 to 60. The areas of bay reproduced at each end were those determined to be sufficient to

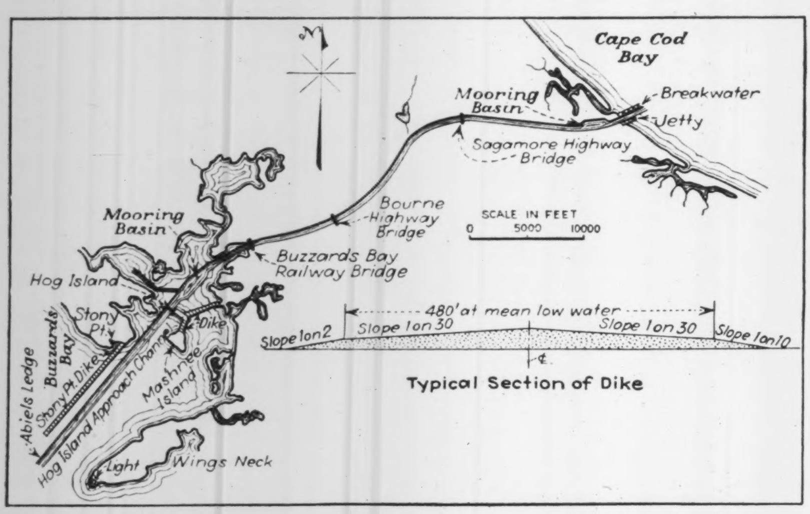


Fig. 2. An ocean approach remodeled by dikes changes the flow and current conditions to non-hazardous character in the enlarged Cape Cod Canal.

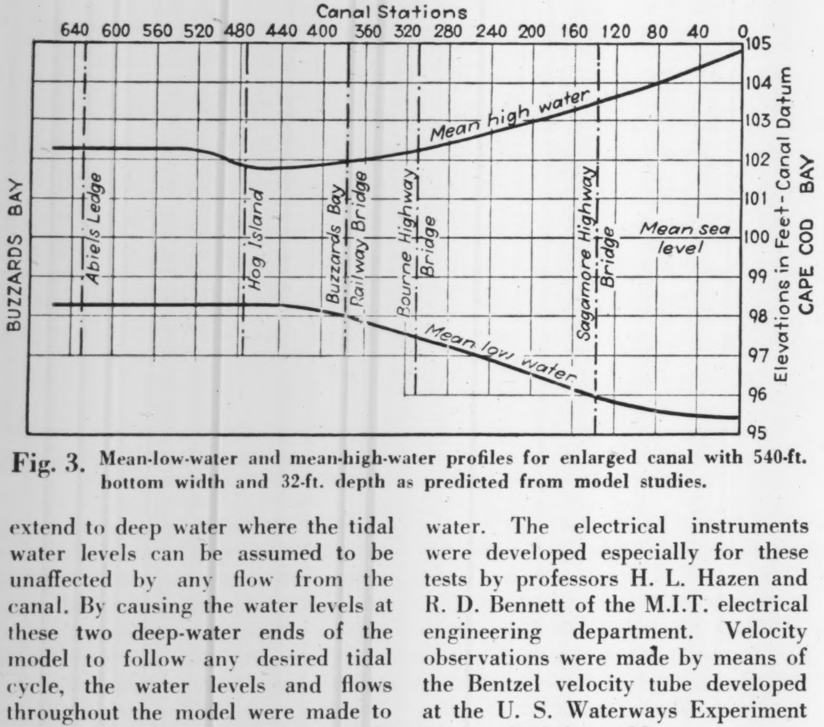


Fig. 3. Mean-low-water and mean-high-water profiles for enlarged canal with 540-ft. bottom width and 32-ft. depth as predicted from model studies.

extend to deep water where the tidal water levels can be assumed to be unaffected by any flow from the canal. By causing the water levels at these two deep-water ends of the model to follow any desired tidal cycle, the water levels and flows throughout the model were made to reproduce in miniature and to scale those occurring in nature.

Water was introduced through the bottom of the model at the ends and the water level was maintained by allowing the surplus to waste over a horizontal hinged steel plate, which was automatically controlled by electrical machinery to reproduce definite tidal cycles to an accuracy of 0.01 in. Measurements of changing water levels were made with corresponding accuracy by measuring changes in electrostatic capacitances between the surface of the water and metal plates suspended above the water. The electrical instruments were developed especially for these tests by professors H. L. Hazen and R. D. Bennett of the M.I.T. electrical engineering department. Velocity observations were made by means of the Bentzel velocity tube developed at the U. S. Waterways Experiment Station, Vicksburg, Miss.

To check the model with nature, the canal was first reproduced with 170-ft. bottom width and 25-ft. depth, and adjustments were made until results in the model agreed satisfactorily with observations made in the actual canal of that size. The model was then rebuilt to simulate the proposed ultimate size (500-ft. bottom width, 40-ft. depth) and, later, the recommended project size (540-ft. bottom width, 32-ft. depth). For each size, observations were made of the tide curves, water surface profiles, propagation of high and low water crests and velocities. Thes data have been used as a basis f planning the enlargement progra

### Need for Buzzards Bay dikes

The model studies indicated that with the enlarged canal, serious eddies and cross-currents would be developed in Buzzards Bay which would undoubtedly make navigation difficult and hazardous. The worst conditions observed in the model were in the vicinity of Hog and Mashnee islands and in the Hog Island approach channel. Studies were initiated to devise means of improving flow conditions in this area.

After preliminary tests of proposed remedial measures, it was found that the observed eddies and cross-currents could be largely eliminated in the model by two dikes connecting the eastern shore of Buzzards Bay with Hog Island and Hog Island with Mashnee Island. Studies were also made of the effect of a dike extending from Stony Point to Abiels Ledge, which was originally proposed to provide a spoil area for hydraulic dredging in the outer portion of the new Hog Island approach channel. The model tests indicated that these dikes would greatly improve flow conditions in Buzzards Bay and would also reduce velocities in the canal.

Supplementary tests were made to determine the feasibility of leaving openings to provide navigable channels for small boats in the Stony Point dike and in the dike between the eastern shore of Buzzards Bay and Hog Island. The conclusion based on these studies that such openings would be impracticable has since been confirmed by observations made during actual construction of the dikes.

Other data secured from the model studies related to the mean-low-water profile, and the velocities to be expected in the enlarged canal. The mean-low-water profile is the datum for channel dredging, the mean-high-water profile forms the basis for determining the elevations to which it is necessary to place bank protection, and the predicted velocities are of particular interest in considering the effects of the improvement program on navigation.

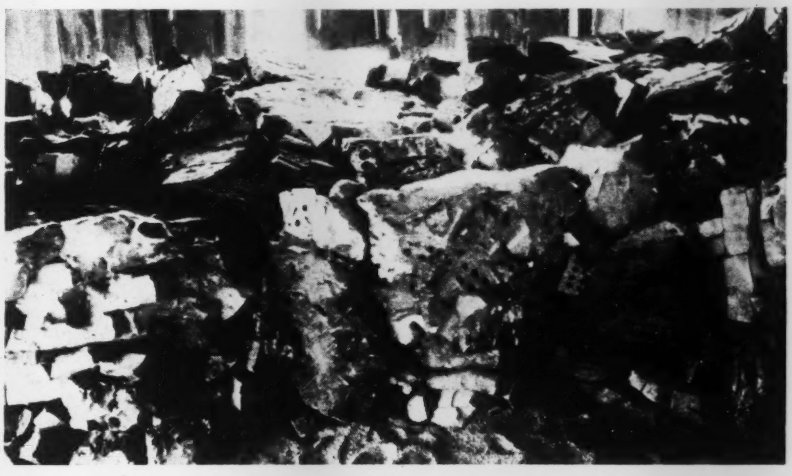
The mean-low-water and mean-high-water profiles derived from the model studies of the enlarged canal with 540-ft. bottom width and 32-ft. depth are shown in Fig. 3. This diagram shows a variation of mean range of tide (distance between mean high and mean low water) in the Buzzards Bay approach from 4 ft. near Abiels Ledge to 3.5 ft. near Hog Island and in the canal proper from 4 ft. at the Buzzards Bay railway bridge to 4.8 ft. at the Bourne highway bridge, 7.5 ft. at the Sagamore highway bridge and 9.4 ft. at the Cape Cod Bay end.

### Canal velocities

Studies of velocities in the model of the 540-ft. by 32-ft. enlarged canal indicate that, at a point about midway between the ends of the canal proper, the maximum velocity for a mean tide will not exceed $5\frac{1}{2}$ ft. per sec. The currents to be expected will, therefore, be of the same order of magnitude as those which existed prior to commencement of the enlargement program. Although such currents were found to be hazardous in the narrow width of the original canal, experience indicates that with the very greatly enlarged size of cross-section the hazards of navigation associated with tidal currents in a narrow channel will be obviated. principally because the enlarged canal will allow greater maneuverability, permitting a vessel to deviate considerably from the center of the canal without the disastrous results that were to be expected in the original canal.

### Direction

The model studies were undertaken for the Corps of Engineers, U. S. Army, by the department of civil and sanitary engineering of the Massachusetts Institute of Technology, Professor C. B. Breed, in charge. The experimental work was done at the M.I.T. River Hydraulic Laboratory under the direction of Professor K. C. Reynolds. The writer was assigned to supervise the tests for the government as resident representative of the district engineer. The work of improvement of the canal is under the supervision of the district engineer, Boston, Mass. Col. John J. Kingman, district engineer, when the model studies were initiated, was succeeded by Lieut.-Col. A.K.B. Lyman before their completion.



FUSED CERAMIC RIPRAP DEVELOPED TO PROTECT SLOPES OF KEYSTONE DAM

# Fused Ceramic Material For Riprap on Keystone Dam

D. A. Buzzell
Chief Hydraulic Engineer, Central Nebraska Public Power & Irrigation District, Hastings, Neb.

***Tests show that fused ceramic blocks will make satisfactory protection for earthfill***

A NEW TYPE of riprap consisting of fused ceramic blocks has been developed for use on the proposed Keystone (Kingsley) Dam of the Central Nebraska Public Power and Irrigation District. This ceramic riprap will be bid on as an alternate to quarry rock. The nearest suitable quarry rock is located about 186 mi. from the dam site and indications are that this long haul would cause the price of stone riprap to be excessively high. Thus, like most inventions, this one was born of necessity. Many western railroads located far from rock supplies have used burnt clay ballast satisfactorily. It is now a matter of common observation that hard-burned brick is almost inert chemically and when burned to the point of vitrification, it is nonabsorbent, tough, hard and resistant to erosion.

The writer, working in collaboration with George Blackstone, chief engineer of a local brick producing concern, experimented for a long time in efforts to fuse ordinary commercial bricks together in various patterns of log cabin type units. The general idea was to heat these units to the point of incipient fusion, when it was hoped that fusion at points of contact, together with the weight of the bricks, would cause them to unite. This was found to be possible, especially with bricks made of clays having a wide range of burning temperature, but not commercially feasible when the burning range was narrow, as it is in loess deposits. No matter how carefully the application of fire is handled, it is almost impossible to prevent the entire contents of a kiln from running together to form a solid mass resembling blast-furnace slag.

The experimenters were on the point of abandoning an apparently hopeless quest when a method was discovered of breaking down this slag-like material into blocks which could be laid up into a dense, heavy, and thoroughly interlocked mat of riprap. The blocks are split with one dimension approximately equal to the thickness of the riprap layer. The largest blocks are laid on their natural beds. It has been found feasible to form blocks weighing up to 1,000 lb. each for the 27-in. riprap, although this is not desirable if they are to be hand-placed. Medium to large blocks are placed with the long axis normal to the ground and with the large ends up. Small blocks, down to bats and much smaller, are used to fill in voids, and with proper management a closely-meshed mat can be formed next to the embankment face. This latter provision is important in preventing erosion.

A final step is to "stuff" all interstices with small blocks, spalls, and chips and to hammer these in with a medium mallet or hand sledge. The sharp, angular contours of the large blocks make interlocking an easy matter.

By actual measurement only one-half a man-hour of labor was required to complete a square yard of 27-in. riprap where all material was carried or rolled from a stock pile located 20 ft. from the site.

When made of common brick, this riprap weighs approximately 2,050 lb. per cu.yd. as placed in the riprap mat. By using pressed brick, this weight can be raised to 2,700 lb. per cu.yd. as placed. This latter figure compared favorably with quarry rock in weight.

The specifications adopted for the Kingsley Dam riprap provide that the ceramic material must pass all of the usual laboratory tests prescribed for high class quarry stone except that a concession is made on the one point of weight. It is believed that the lack of weight is more than counterbalanced by the following points of superiority:

(1) The angular blocks have a natural tendency to interlock. (2) Interstices between the large blocks are crooked and tortuous and so help check the loss of fine materials from the embankment face. (3) It has so far been impossible to cause any disintegration of the ceramic material by the "soundness" test. Endless repetitions of the freezing cycle either with water or sodium sulphate have so far failed to produce any appreciable breakdown of samples. (4) The material is chemically inert or very nearly so. This is not true of any stone. (5) The probable cost, except when excellent quarry stone is located very close to the site, is favorable to use of the ceramic material.

It should also be borne in mind that the deficiency in weight can be made up by increasing the thickness of the ceramic mat as compared with an equivalent stone mat.

Kingsley Dam will require the use of 500,000 sq.yd. of riprap, varying in thickness from 15 to 30 in. If made of ceramic material, this will require the production of 110,000,000 commercial sized bricks, to be fused into the blocks. Indications are that a brick plant, capable of producing 450 tons per day, will be erected close to the upstream face of the dam so that haulage will be reduced to a minimum.

Actual test results on representative samples of ceramic riprap are as follows:

| | |
|---|---|
| Crushing strength | 10,000-25,000 lb. per sq. in. |
| Absorption (A. S. T. M. C67-31) | 1.5 to 12 per cent. |
| Soundness (A. S. T. M. T-35) | 15 cycles (negligible loss) |
| Wear (A. S. T. M. D2-33) | 6 per cent. |
| Toughness Index (A. S. T. M. D3-18) | 11 |

The soundness of ceramic material apparently has no relation to the per cent of absorption although there is an important relation between these two characteristics for stone.

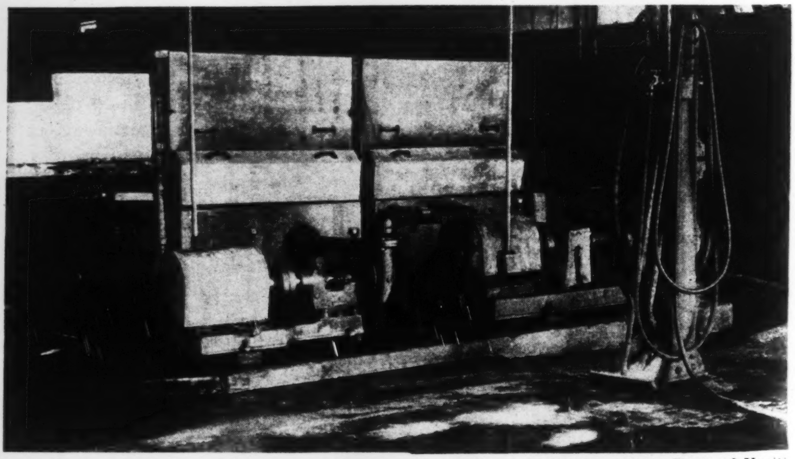
# Steam Sterilized Garbage Cans

*Municipal garbage collection in Lansing, Mich. provides special hygienic service features*

A CLEAN GARBAGE can sterilized with steam comes to the homes of Lansing, Mich. citizens every time collections are made. This unusual practice in municipal garbage service is made possible through city-wide use of a standard size receptacle and the development of a can-washing machine which will handle 20 cans a minute.

The system, used since 1920, has been highly successful according to Carl H. Hoien, superintendent of the garbage department. The city buys the cans which are of 10 gal. capacity fitted with covers, and rents them for $1.50 a year. A city ordinance makes it mandatory that all garbage other than that destroyed in an approved home incinerator be handled in this manner. The metal receptacle with a tight-fitting cover costs the city about $1.50 and has a life of about three years.

At the present time 14,750 cans are being rented and this brings in a revenue of $22.000 a year. The total cost of collection and can cleaning amounts to about $79,000; this figure also includes the hauling of garbage from the transfer station to a privately operated hog farm.



Photos Courtesy Michigan State Dept. of Health

Fig 1. Can washing and sterilizing machines designed by the city.

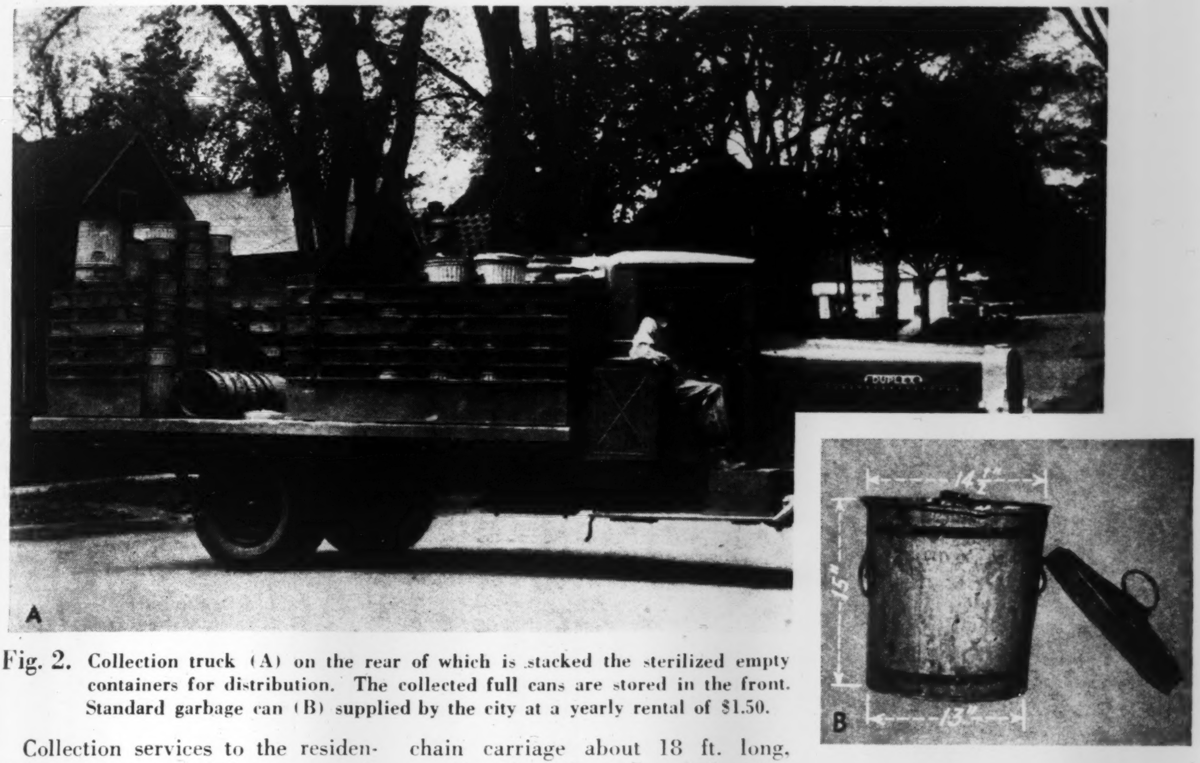


Fig. 2. **Collection truck (A) on the rear of which is stacked the sterilized empty containers for distribution. The collected full cans are stored in the front. Standard garbage can (B) supplied by the city at a yearly rental of $1.50.**

Collection services to the residential areas are provided once a week during the winter months and twice a week in the summer. In the business district collections are made once every day. Collections will average 170 tons and 220 tons per week, respectively, in the winter and summer season. The city does not collect rubbish.

### Collection procedure

Collections are made with four flat-bottom, stake side motor trucks carrying a crew of three men. Each day an average of 3,300 full containers are collected and clean ones substituted for them. The collectors, who receive $35 a week, have no stated hours of work but are through for the day when their route coverage has been completed. This system speeds up collections and consequently it is possible to complete the washing and sterilizing operations quite early in the day and thus make a considerable saving in fuel used for generating hot water and steam.

### Cleaning machine design

The cleaning machine is one which has been developed and constructed by the city at a cost of about $1,600. Essentially it consists of an endless chain carriage about 18 ft. long, moving through a metal housing which serves to confine the hot water steam sprayed over the cans as they are carried along bottoms up on the carriage conveyor. Three motor-driven pumps, each with a capacity of 500 gal. per min., supply the pipe and jet sprays which are located at intervals above and below the conveyor.

The conveyor is operated at speeds such that 20 cans per minute are passed through the machine. The hot water, which is heated to a temperature of 180 deg. F. with live steam, is recirculated until 900 cans have been washed. The recirculation storage tank is fitted with a screen on which is retained the largest pieces of debris washed from the cans.

Only one machine is in use at the present time but next year, when garbage disposal operations are transferred to the new sewage treatment plant, two machines will be installed. They will be located adjacent to the hammermill grinders in which garbage will be macerated previous to its digestion along with sewage sludge. The layout is such that as the full cans are transferred from truck to platform, they can be quickly emptied and placed directly on the washing machine.

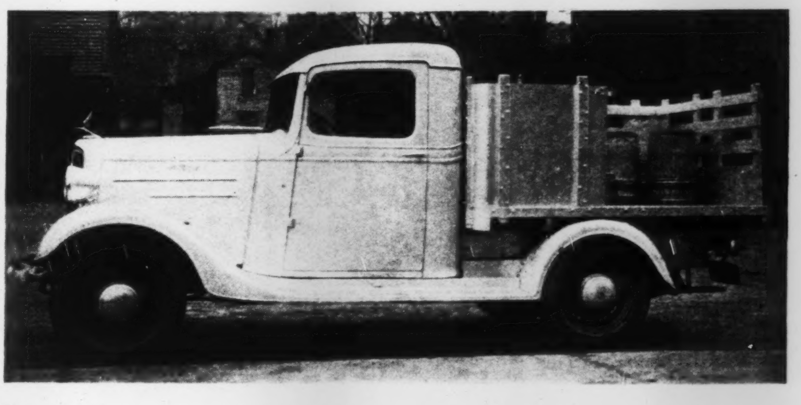


Fig. 3. **New customers and complaints are serviced with this smart looking truck.**

# *FROM FIELD AND OFFICE*

*Working problems and time-saving methods . . . Edited by Charles S. Hill*

## Locating Retaining-Wall Stems

W. M. Borgwardt
U. S. Engineer Office, Vicksburg, Miss.

In designing cantilever retaining walls, it is the usual custom to make the toe projection equal to one-third the base width. This is almost never, and sometimes not even approximately, the correct position of the stem for maximum stability of the wall against overturning. A quick and easy method of determining the exact location of the stem, so that the required base width is a minimum, is presented.

For the purpose of demonstrating the principle, the simple case of a reservoir wall, with dimensions and loading as shown in Fig. 1, will be considered. Weight of the wall is assumed to be 150 lb. per cu.ft.

Problem: Design the wall so that the base width is a minimum when the resultant passes through the outside kern point.

Procedure: Consider the stem moved a distance $\Delta x$ to the left as shown in Fig. 2. Then the increment of load due to this movement is,

$$\Delta W = -62.5(11)\,\Delta X = -687.5\,\Delta X \qquad (1)$$

Taking moments about the point $A$

$$\Delta M = 150(11)\,\Delta X - 62.5(11)\,\Delta X(1 + \tfrac{1}{2}\Delta X)$$

$$= 962.5\,\Delta X - 343.75\,\Delta X^2 \qquad (2)$$

$$\frac{\Delta M}{\Delta W} = \frac{962.5\,\Delta X - 343.75\,\Delta X^2}{-\quad 687.5\,\Delta X}$$

$$= -1.40 + 0.5\,\Delta X \qquad (3)$$

Since the second term of equation (3), for an infinitesimal movement, is equal to zero, the effect of such a movement is the equivalent to the application of a negative load of 687.5 lb. at a distance of 1.40 ft. from the face of the stem, measured toward the toe, and if this should coincide with the point at which the resultant cuts the base, then a movement of the stem would have the least possible effect in influencing the movement of the resultant. If then we place the stem so that the toe projection is equal to $b/3 + 1.40$, the required base width $b$ will be a minimum if the resultant passes through the kern point, and a movement of the stem in either direction will cause the resultant to pass outside the middle third of the base.

Taking moments about any convenient point on the base, Fig. 2, and solving for $b$, we find it to be 17.86 ft. Moving the stem 1 ft. to the left causes the resultant to fall 0.11 ft. outside the middle third, and moving the stem 1 ft. to the right, causes it to fall 0.06 ft. outside. Placing the stem so that the toe projection is equal to $b/3$, we find the required value of $b$ equal to 18.22 ft.

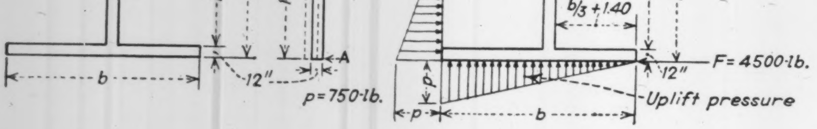


FIG. 1 FIG. 2 FIG. 3

Graphics of process for exact location of stem on the base of cantilever walls.

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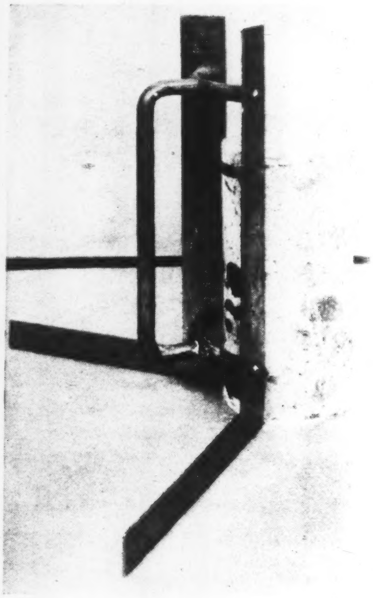
## Gage For Capping Cylinders

M. E. Prior
Dewey and Almy Chemical Co.
Cambridge, Mass.

There are many devices now in use for squaring the caps of concrete test cylinders, but most of them are inconvenient to handle and take considerable time to manipulate. As we have to cap over 10,000 cylinders a year in our research laboratories a simpler, more rapid tool was necessary. The device illustrated not only fulfills these specifications but gives more accurate data with a remarkably small loss of caps.



Carpenters' steel squares make an accurate frame for capping concrete test cylinders

The device consists of two 10x12-in. steel squares fastened together by sections of steel rod. The squares are set at a 90 deg. angle on a 2-in. radius for capping 4x8-in. cylinders. The radius, of course, may be changed to accommodate any size cylinder. With this device it is possible to square a cylinder on the capping material in one operation, and the result is several cylinders a minute, all with perfect caps. The device not only eliminates the possibility of inaccurate caps, but also, due to its speed of manipulation, it cuts down on spoilage of caps due to the rapid stiffening of capping material.

JUST a tractor and a gooseneck boom on rubber tires made a building crane for which Fred Harbers Sons, contractors of Peoria, Ill., have found many uses.

## Bomb Quenches Fires on Water

F. R. Cozzens
Stockport, Ohio

A very serious hazard in present day floods is floating gasoline or oil which has been released from inundated storage tanks. The "splotches" may contain from a few gallons to a thousand barrels or more of inflammable material, and due to the manner in which the blaze spreads over the water's surface, ordinary methods of control are of little value. Along the Ohio Valley waterways where floods are common, excellent results are being obtained by means of a dynamite bomb.

The bomb consists of four, $1\frac{1}{4}$x8 in. cartridges of 40 per cent ammonia dynamite, tied into a bundle. A stout cord around the pack, 2 in. from each end, holds the cartridges in position, and these cords are connected in the center to a 1-ft. length of wire which in turn is attached to a float made from cork or wood. In the end of one cartridge is inserted a blasting cap, snugly taped to a 1-ft. length of waterproofed fuse.

These bombs are prepared in advance and stored for emergencies. When an oil or gasoline splotch is seen on flood waters, workers from boats light the fuse on a bomb and drop it as nearly in the center of the splotch as possible. Force of the blast invariably stifles the blaze, and breaks up the oily film completely. One bomb is usually sufficient to snuff out a 100-sq.ft. blazing film.

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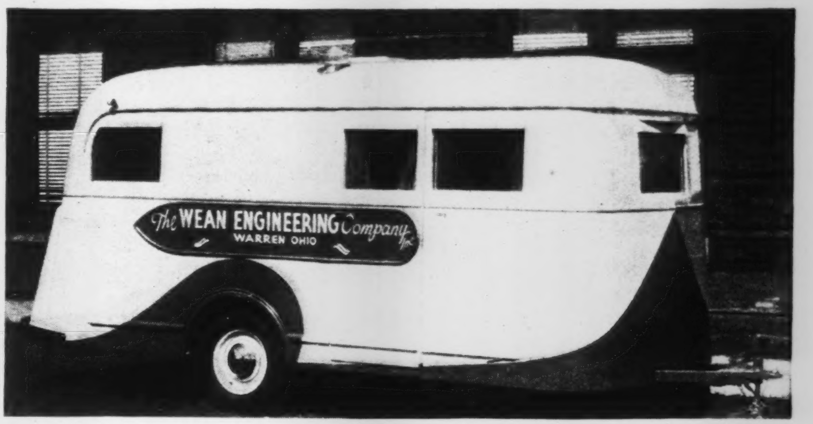
## Blasting Pole Holes

Arthur La Motte
E. I. du Pont de Nemours & Co.
Wilmington, Del.

Difficulty is often experienced in digging post holes in soft soil, sand or swamp land flooded with water. Often caissons are required to keep water and soil from filling up the pole hole before the pole can be set. In such situations considerable success has followed the practice of blasting the pole hole and setting the pole in one operation.

A hollow drill of about $1\frac{1}{2}$-in. pipe is driven into the ground to the depth desired for the bottom of the pole. The soil is forced out through the lower end of the drill with a ram. A sand point on the end of the drill will help where the soil is such that it clogs the pipe, making ramming difficult. The pipe can be withdrawn, leaving the sand point.

The charge of dynamite, primed preferably with an electric blasting cap, is pushed down through the pipe to the bottom and the pipe withdrawn. The pole is then raised above the surface directly over the dynamite and held in place by pike poles or by rigging four ways, and the dynamite is detonated. The explosion creates a pear-shaped pocket into which the pole will settle.



The Wean Engineering Co., contractors for machinery erection that calls them all over the country, have adopted this trailer as a field office.

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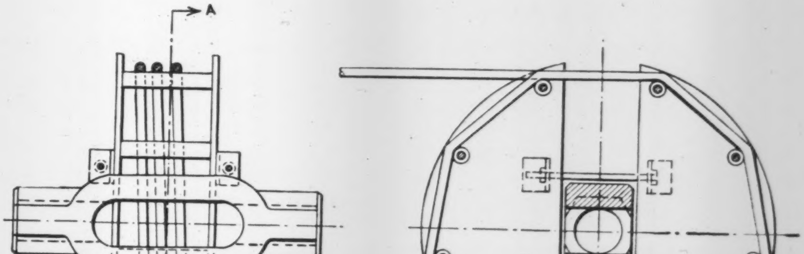
## Turnbuckle Tightener

H. L. Schlubach
Larchmont, N. Y.

A simple device to operate a turnbuckle in cramped quarters is shown by the accompanying sketch. The device was developed to meet a situation at Grand Coulee dam. On the inside of the diversion gates 3-in. diam. upset rods were used as tension chords to maintain the 50-ft. radius arch. These rods were tightened with two turnbuckles, which, due to cramped quarters, were hard to turn. By making the attachment shown, which was fastened to the turnbuckle, the line of an air tugger hoist was used to tighten the turnbuckle.

Two circular disks 24 in. in diameter were cut out of $\frac{3}{8}$-in. plate and notched to receive the turnbuckle. Bolts with pipe spreaders 6 in. long and about 8 in. apart made a drum of the plates. The drum was slipped over the turnbuckle and two bolts passed through two lugs on each side of the drum locked it in place. Enough cable from the tugger hoist was wound around the drum to give the turnbuckle the required number of turns. While operating the tugger, rods on the turnbuckle were held with large pipe wrenches.



Drum for tightening a turnbuckle by power.

# Salmon Pass Galloway Plant

JAMES WILLIAMSON
Consulting Engineer, Westminster, England

*Experience at hydro-electric plants in Scotland shows that fish can pass through the turbines with safety*

FEARS that there may be a large loss of young salmon in the turbines of the Bonneville power plant on the Columbia River, as expressed in *Engineering News-Record* of Sept. 23, p. 498, do not find support in experience gained at hydro-electric plants in Scotland. Consequently, an outline of the tests conducted there may be of interest to American engineers at this time.

The problem of passing smolts (salmon at the stage when they first descend to the sea) through water wheels was closely studied about four years ago in connection with the power station arrangements in the Galloway Water Power Scheme on the River Dee in the southwest of Scotland. The scheme involves four power stations on the course of the river and its main tributary, one of the power stations being at tidal water at the head of the estuary. It was essential that salmon and sea trout should ascend and smolts descend past three of the stations.

Provision for the ascent of salmon has been successfully met by ladders of the pool and orifice type with large resting pools at intervals. The ladders were available for descent of smolts and some of them do take the ladder route but the larger proportion are attracted to the intakes of the power station pipe lines. The arrangements at the Tongland power station, the lowest of the group, which is typical, is as follows: The head is created by a dam 70 ft. high, ¾ mile above the power station. The fish ladder surmounts the dam. There is a fall of 50 ft. in the river from the dam to the power station, the bed being rocky with frequent pools. The station operates on peak load with a daily variation of reservoir level up to 10 ft. range. The working head varies between 90 and 115 ft. Between the dam and the power station the river is dry in all but flood seasons except for the fish ladder flow and occasional supplementary flow. The pressure pipe line supplying the power station is of about 20-ft. diam. and carries a maximum flow of 4,500 sec.-ft. The station has three vertical 11,000 kw. units with runners about 9-ft. diam., space between blades about 10 in. max., and speed 214 r.p.m. There is an open type surge tank of 100-ft. diam. a short distance above the station with large throat forming connection with the pipe. The pipe trifurcates under the tank into three branches of 11-ft. 6-in. diam., one to each machine.

Numerous studies were made of arrangements for shedding smolts away from the intake and leading them to the fish ladder entrance at the other side of the dam but no method likely to achieve success within reasonable cost was found. It was considered by the engineers that in view of the ample passage way between the blades, the majority of the small fish should pass through as part of the streams of water without physical damage by impact with any metal parts. It was not known, however, whether the rapid change in a few seconds from high pressure at the entrance to the turbine to partial vacuum at the outlet might damage the fish by injuring the swimming bladder. Therefore, a special tank with observation windows was devised in which small fish were subjected to a gradually increasing pressure up to 100-ft. maximum head corresponding to a journey from the intake to the turbine and a sudden release in two seconds or so to 15 ft. of vacuum head. A number of tests were made corresponding to different conditions of flow and head. The small fish swam about in the tank and appeared unharmed.

The station commenced running towards the end of the first smolt season in May, 1935, and it was found that some smolts did pass down the fish ladder and that others passed down the pipe line, also that very few dead or damaged fish could be seen in the tail race. Examination of the surge tank during tests with small garden labels showed that a large number of smolts were in the surge tank swimming about near the surface. These tests were under way on a Saturday and as the station could be off load at weekends it was arranged that the intake gate should be shut on the Saturday afternoon and the surge tank and pipe line emptied through two of the turbines, the power generated being absorbed in the test tank. On this occasion the emptying occupied about two hours and about 500 smolts passed through towards the end of the process. Inspection and collection of fish in the tail race by a number of observers indicated that possibly 20 fish were killed and 100 stunned and that most of the latter revived after ten or fifteen minutes. The emptying through the machines occupied about two hours and it was ascertained that in order to achieve this slow rate the power station engineer had closed the guide vanes to about 1½ in. clear spaces. All the fish passed through these narrow gaps. In addition to the fish, large numbers of the garden labels passed through and of 114 collected, four were broken.

No further tests could be made until the following spring but as a result of this and succeeding tests normal procedure has been established which involves evacuating the surge tank through a machine with the guide vanes well open on several occasions when the smolts are running. With this procedure some thousands of fish may be passed through at a time, and the proportion of damaged fish appears to be negligible.

The successful results in this scheme have probably been greatly facilitated by the fact that all the stations are shut down at frequent intervals, normally every night and at weekends. When a station shuts down any ascending fish which have hitherto been attracted by the strong outflow from the draft tubes have opportunity to find the alternative and smaller flow from the river or fish ladder and their upstream instinct drives them on. This work was under the direction of the writer as chief engineer for Sir Alexander Gibb & Partners.

# THE WEEK'S EVENTS

*(Continued from page 767)*

## OBITUARY

**Ralph N. Wheeler**, 64, until his retirement in 1931 engineer in charge of maintenance on the Catskill aqueduct in New York City, died in Cocoa, Fla., May 7. Wheeler, a graduate of Massachusetts Institute of Technology, joined the division of water supply of the city of Brooklyn in 1895. He remained there until 1900 when he was transferred to the Rapid Transit Railroad Commission of the City of New York as assistant on subway construction work. Later he spent several years with the T. A. Gillespie Co., and in 1907 he re-entered the employ of the City of New York as division engineer of the board of water supply, working on construction of the Catskill aqueduct.

**Joseph L. Slone**, retired Cincinnati contractor, died there May 15 at the age of 56. Slone was in the contracting business for more than 25 years.

**Harry D. Macaulay**, a civil engineer of St. John, N. B., died in Montreal May 14 at the age of 49. Macaulay studied at the University of Brunswick and the University of Wisconsin, with some intervening engineering work in England. After leaving Wisconsin, he worked on the engineering staff of the Chicago & Northwestern Railroad for several years and later joined the staff of the Canadian National Ry. In 1913 he transferred to the Canadian department of public works as assistant engineer at St. John, and he later worked there for the local harbor commission. Since 1937 he had been with the Aluminum Co. of Canada as resident engineer on terminal facilities at Port Alfred, Que.

**Robert A. Greenfield**, Buffalo, N. Y., engineer and architect, died in Geneva, N. Y., May 15. Greenfield served an apprenticeship with the Buffalo firm of Green & Wicks and later opened his own offices in partnership with Metzger. He was also for a number of years supervising construction engineer for the Treasury Department. During the war, Greenfield served in France with the 303rd Engineers, attaining the rank of major.

**Edward O'Keefe**, who was engineer in charge of construction on what is said to have been the world's first hydro-electric plant, at Appleton, Wis., died there May 18 at the age of 83. O'Keefe was the builder of many early industrial plants in Wisconsin. The original Appleton hydro-electric plant in the Fox River began operation in 1882.

## CALENDAR OF MEETINGS

### NATIONAL SOCIETIES

**American Society for Testing Materials**, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 27-July 1.

**Society for the Promotion of Engineering Education**, annual meeting, Texas A. & M. College, College Station, Texas, June 27-30.

**American Institute of Electrical Engineers**, summer convention, Washington, D. C., June 20-24.

**American Society of Civil Engineers**, annual convention, Hotel Utah, Salt Lake City, July 20-22.

**American Institute of Electrical Engineers**, Pacific Coast convention, Portland, Aug. 9-12.

### REGIONAL AND LOCAL

**Pennsylvania Sewage Works Association**, annual conference, State College, Pa., June 8-10.

### ELECTIONS AND ACTIVITIES

**S. A. Weakley** has been elected president of the Nashville chapter of the American Society of Civil Engineers. L. R. Currey was elected vice-president, and William T. St. Clair, secretary-treasurer.

**Newly elected** president of the North Central Ohio Society of Professional Engineers is Charles W. Conklin. I. R. Ault is vice-president, Carl Small, secretary, and K. A. Poister, treasurer.

**The Engineering Society of Buffalo**, N. Y., at its annual meeting last month, elected Thomas L. Mayer, president. Other officers are: vice-president, Felix E. Prochnow; treasurer, Robert K. Keegan; secretary, J. E. Roy.

**The Association of Professional Engineers** of the Province of Ontario has established permanent offices in the Atlas Building in Toronto.

**New president** of the Maryland-Delaware Water and Sewerage Association is C. J. Bruce, who was elected at the annual conference in Baltimore late last month. A. M. Tawney is 1st vice-president and G. E. Harrington, 2nd vice-president. A. W. Blohm was re-elected secretary-treasurer. E. C. Cromwell and E. St. Clair Maxwell have been added to the executive committee.

**The Metropolitan section** of the American Society of Civil Engineers at its annual meeting last month elected the following officers: President, Rear Adm. R. E. Bakenhus; vice-presidents, Dean G. Edwards and John C. Riedel; secretary, Wm. J. Shea; directors newly elected are David Bonner, Jay Downer and L. J. Bevan.

**The dominating** subject of discussion at the annual meeting of the St. John, N. B. branch of the Engineering Institute of Canada was the negotiations for combining the Engineering Institute of Canada and the Association of Professional Engineers. New officers elected are: W. H. Blake, president; H. F. Morrisey, vice-president; F. A. Patriquen was elected secretary-treasurer.

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## Short Courses

**Water and sewage treatment** short course for plant operators is to be held at Berkeley, Calif. June 22-24 under the auspices of the California Section, American Water Works Association, and the California Sewage Works Association.

**A training school** for highway superintendents will be held at Cornell University, Ithaca, N. Y., June 22-25. It is sponsored jointly by the Town and County Officers Training School of New York State, the State Association of Superintendents of Town Highways, the State College of Agriculture, and the College of Engineering.

**Course** for public health workers and sanitarians employed by Texas municipalities, at Texas Technological College, Lubbock. Sponsored by state Department of Health and League of Texas Municipalities.

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## License Examinations

**Michigan**: Examination for architects at the Universities of Michigan and Detroit and for engineers and land surveyors at the Universities of Michigan and Detroit, Michigan State College and Michigan College of Mining and Technology, June 20-22.

# MATERIALS AND LABOR PRICES

*Market quotations on construction materials and wage rates reported monthly by ENR correspondents*

LOWER lumber prices are the principal price change for the third successive month. Southern Pine is down $1.00 to $3.00 in Chicago; down $1.50 to $4.50 in Dallas; down 50c. to $2.00 on 1- and 2-in. sizes in St. Louis, except on 2 x 10-in. which is up 50c. Western Pine is off $5.00 per M ft. in Minneapolis on 1-in. sizes, and Native Pine is $2.00 to $3.00 lower in Denver. Douglas Fir is $8.00 to $10.00 lower in Minneapolis, and $2.00 lower on 2 x 8-in. size in Chicago. Fir timbers are off $1.00 in Chicago and St. Louis, and $5.00 in Minneapolis. Native Pine timber is $1.00 lower on 6 x 12-in. size in Denver. Fir plywood base price at Seattle is up to $70.13 on the ⅝-in. size and $80.03 on the ¾-in. size.

Portland cement is 5c. per bbl. lower in Minneapolis. Gravel and crushed stone is 32c. lower in Los Angeles, while gravel is up 10c. per cu. yd. in New York. Sand is up 6c. in Kansas City, 5 to 10c. in New York, and off 2c. in Los Angeles. Ready-mixed concrete is off 71c. per cu. yd. in Los Angeles.

Common labor on buildings is up 8½c. in New York from the former 95c. per hr. rate. Philadelphia common labor rates, formerly 40 to 50c. per hr., closed the span and the 50c. rate now prevails. Bricklayers, carpenters, structural ironworkers and plasterers rates are 25c. per hr. higher in Dallas than when last reported. Carpenters in Philadelphia receive $1.75 per hr., an increase of 25c. from their former rate.

## CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

| | PORTLAND CEMENT Per bbl., carload lots, including 40c per bbl. for bags, cash discount not included | | | SAND AND GRAVEL Per ton, carload lots | | | CRUSHED STONE Per ton, carload lots | | CRUSHED SLAG Per ton, carload lots, f.o.b. plant | | CONCRETE Ready Mixed 1:2:4, 50 c.y. or more, delivered |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cloth Bags*a* | Paper Bags | Bulk | Gravel, 1½ in. | Gravel, ¾ in. | Sand | 1½ in. | ¾ in. | 1½ in. | ¾ in. | |
| Atlanta | $2.93 | $2.68 | $2.60 | $1.75 | $1.85 | $1.95 | $1.65 | $1.75 | $1.55 | $1.65 | $7.75 |
| Baltimore | 2.35 | 2.10 | 1.90 | 1.80‡ | 1.80‡ | 1.30‡ | 1.80‡ | 1.80‡ | 1.75‡ | 1.75‡ | 7.25 |
| Birmingham | 2.55 | 2.30 | 1.99 | 1.80 | 1.80 | 1.45 | 1.00 | 1.00 | .90 | 1.15 | 5.45 |
| Boston | 2.29*b* | 2.04*b* | 1.84*b* | 1.20 | 1.20 | .85 | 1.20 | 1.20 | .... | .... | 6.50*m* |
| Chicago | 2.60 | 2.35 | 2.20 | 2.00‡*d* | 2.00‡*d* | 2.00‡*d* | 2.00‡*d* | 2.00‡*d* | 1.25‡ | 1.25‡ | .... |
| Cincinnati | 2.56 | 2.31 | 2.05 | 1.20 | 1.20 | 1.30 | 1.80 | 1.80 | .... | .... | 6.60 |
| Cleveland | 2.34 | 2.09 | .... | 1.60*i* | 1.60*i* | 1.50*i* | 1.65*i* | 1.65*i* | 1.65*i* | 1.65*i* | 6.65*i* |
| Dallas | 2.30 | 2.05 | 1.85 | 1.60*p* | 1.60*p* | 1.35*p* | 1.69*p* | 1.84*p* | .... | .... | 6.50 |
| Denver | 3.02 | 2.77 | .... | 1.20 | 1.40 | .90 | .... | .... | .... | .... | 7.25 |
| Detroit | 2.03 | 1.78 | 1.58 | 1.05 | 1.15 | .85 | 1.40 | 1.45 | 1.15‡ | 1.25‡ | 6.50 |
| Kansas City | 2.59 | 2.34 | 2.10 | 1.85 | 2.30 | 1.21 | 1.85 | 1.80 | .... | .... | 7.90*n* |
| Los Angeles | 2.32 | 2.12 | .... | 1.68 | 1.68 | 1.68 | 1.68*f* | 1.68*f* | .... | .... | 6.89 |
| Minneapolis | 2.90 | 2.65 | .... | 1.00*h* | 1.00*h* | .25*h* | 1.00*h* | 1.00*h* | .... | .... | 7.15*j* |
| Montreal | .... | .... | 1.70*c* | .95 | .85 | 1.20‡ | 1.15‡ | 1.25‡ | .... | .... | 7.00 |
| New Orleans | 2.41 | 2.16 | 2.01 | 1.50 | 1.50 | 1.25 | .... | .... | .... | .... | 7.25 |
| New York | 2.45‡ | 2.20‡ | .... | 1.35*de* | 1.35*de* | .80/.85 | 1.65*de* | 1.75*de* | .... | .... | 7.70 |
| Philadelphia | 2.59 | 2.34 | 2.14 | 1.55‡ | 1.65‡ | 1.35‡ | 2.00‡ | 2.05‡ | 1.00 | 1.00 | 8.25*k* |
| Pittsburgh | 2.44 | 2.19 | 1.99 | 1.80‡ | 1.80‡ | 2.10‡ | 2.25‡ | 2.25‡ | 1.50 | 1.50 | 8.75 |
| St. Louis | 2.55 | 2.30 | .... | 1.50‡ | 1.50‡ | 1.25/1.50‡ | .85*h* | .85*h* | .75*g* | .75*g* | 7.50 |
| San Francisco | 2.72 | 2.52 | 2.20 | 1.35 | 1.35 | 1.35 | 1.50 | 1.50 | .... | .... | 7.50 |
| Seattle | 3.10*o* | 2.85*o* | .... | 1.17*o* | 1.17*o* | 1.17*o* | 1.33*o* | 1.33*o* | .... | .... | 7.30*o* |

‡Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* Sales tax included. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount 35c. 500 to 2000; 70c. 2000 to 5000; 95c. over 5000. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c per ton off, cash 15 days.

CASH DISCOUNTS, CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice, in Montreal 5% if payment before 15th.

### CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

| | Bagged | Bulk | | Bagged | Bulk | | Bagged | Bulk |
|---|---|---|---|---|---|---|---|---|
| Buffington, Ind. | $1.70 | $1.65 | Ironton, Ohio | $1.60 | $1.55 | Northampton, Pa. | $1.65 | $1.60 |
| Crestmore, Calif. | 1.72 | .... | Iola, Kans. | 1.70 | 1.65 | North Birmingham, Ala. | 1.75 | 1.70 |
| Dallas, Tex. (Inc. 5c. tax) | 1.80 | 1.75 | La Salle, Ill. | 1.70 | 1.65 | Richard City, Tenn. | 1.85 | 1.80 |
| Hannibal, Mo | 1.70 | 1.65 | Limedale, Ind. | 1.70 | 1.65 | Steelton, Minn | 1.80 | 1.75 |
| Hudson, N. Y | 1.75 | 1.70 | Mason City, Ia. | 1.70 | 1.65 | Universal, Pa | 1.65 | 1.60 |
| Independence, Kans | 1.70 | 1.65 | Norfolk, Va. | 1.70 | 1.65 | Waco, Tex. (Plus 5c. Tax in Texas) | 1.75 | 1.70 |

LOWER PENINSULA, MICHIGAN. Uniform carload lot cement price established March, 1937.

## PAVING BRICK, BLOCKS, ASPHALT, ROAD OILS—F.O.B. CITY

| | PAVING BRICKS AND BLOCKS | | | PAVING ASPHALT Per ton, less than 80 penetration, | | ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration, | | CUTBACK ASPHALT Per ton, | | ROAD OILS Per gal., | ASPHALT EMULSION Per gal., | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Granite per M, lots of 50,000, 4x4x8 in. | Brick per M, 3x4x8½ in., carload lots | Wood per sq. yd., 3½-in. 16-lb. treat | Tank car | Drums | Tank car | Drums | Tank car | Drums | Tank car | Tank car | Drums |
| Atlanta | $75.00 | $39.35 | $2.25 | $17.20*e* | $22.41*e* | $0.0678*e* | $0.0999*e* | $.0718*he* | $.1039*he* | $0.0618*e* | $0.0834 | $0.0834 |
| Baltimore | 140.00 | 44.00‡ | 2.75 | 15.00 | 20.00 | .06 | .085 | .07*h* | .10*h* | ...... | ...... | ...... |
| Birmingham | ...... | 25.00 | ...... | 18.20 | 23.20 | .0747 | .0997 | .0834*h* | .1134*h* | ...... | ... | ...... |
| Boston | 70.00 | 46.50 | 3.00 | 15.00 | 20.00 | .06 | .085 | .07*h* | .10*h* | .07‡ | .09‡ | .12‡ |
| Chicago | 140.00 | 50.00 | 2.40 | 15.00 | 20.00 | 14.00*g* | 19.00*g* | .07*h* | .11*h* | .04 | .08 | .12 |
| Cincinnati | 112.00 | 37.50 | ...... | 13.47 | 17.47 | .12 | ...... | 17.00 | ...... | .051 | .078 | ...... |
| Cleveland | 110.00 | 37.50 | 2.85 | 17.44 | 21.44 | .075 | .09 | .08*h* | .09*h* | .05 | .09 | .095 |
| Dallas | ...... | 30.50 | ...... | 12.00 | 17.00 | .04 | .07 | 13.00 | 18.00 | .035 | .05/.07 | .07/.09 |
| Denver | ...... | 27.50 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | .... |
| Detroit | ...... | 35.00 | ...... | 16.72*f* | 21.97*f* | 15.60 | 19.11*g* | 14.10 | 20.60 | .0535 | .0661 | .0995 |
| Kansas City | ...... | 44.00 | ...... | 18.50 | 23.50 | .077 | .1075 | .077*h* | .107*h* | .057 | .11 | .15 |
| Los Angeles | ...... | 50.00 | ...... | 11.00 | 15.16 | 11.00*g* | 15.16*g* | 11.00 | ...... | .042 | .06 | .12 |
| Minneapolis | ...... | ..... | 1.90*d* | 21.90 | 26.90 | .10 | .14 | 23.80 | 33.35 | .0645 | ...... | ...... |
| Montreal | 85.00*c* | 57.00 | 3.63 | 14.60 | 21.25 | .105 | .135 | .101*h* | .121*h* | .0935 | .135 | .165 |
| New Orleans | ...... | ..... | ...... | 14.00*a* | 19.00*a* | .055 | .085 | .06*h* | .09*h* | .05 | ...... | ...... |
| New York | ...... | 68.00 | 2.85 | 15.10 | 20.50 | .06 | .085 | .07*h* | .10*h* | ...... | .075 | .11 |
| Philadelphia | 120.00 | ..... | ...... | 14.00 | 19.00 | .055 | .08 | .06*h* | .09*h* | .05 | .06 | .09 |
| Pittsburgh | 115.00 | 40.00 | ...... | 19.00 | 24.00 | .077 | .1125 | .068*h* | .121*h* | .0675 | ...... | ...... |
| St. Louis | 110.00/121.00 | 37.00 | ...... | 17.00 | 22.00 | .07 | .10 | .075*h* | .105*h* | .04 | .075 | .105 |
| San Francisco | ...... | 70.00 | ...... | 12.00 | 18.00 | 12.00*g* | 18.00*g* | 12.50 | 23.00 | .04 | .0475 | .117 |
| Seattle | ...... | 60.00*i* | ...... | 22.50 | 27.55 | 20.50*g* | 25.55*g* | 15.70/16.70 | 29.20/30.20 | 7.80/8.75 | .0575 | .1375 |

‡Delivered. *a* F.o.b. Baton Rouge. *b* 4x5x9 in. aver. *c* Sales tax included. *d* 2½ in. 6 to 8-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican *g* Per ton. *h* Per gallon. *i* 3½x4x8½ in.

(Continued on following second page)